

JANIS 75
Volume No. 1 of 2

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JOINT ARMY - NAVY
INTELLIGENCE STUDY

OF

KOREA

(Including Tsushima and Quelpart)

★

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Chapter I - Brief
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 Chapter III - Oceanography
 Chapter IV - Coasts and Landing Beaches
 Chapter V - Climate and Weather
 Chapter VI - Port Facilities
 Chapter VII - Transportation and Telecommunications
 Chapter VIII - Cities and Towns
 Chapter IX - Resources and Trade
 Chapter X - People and Government
 Chapter XI - Health and Sanitation (Restricted)
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 Chapter XIII - Naval Facilities
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 Chapter XV - Gazetteer and Map Appraisal (Restricted)

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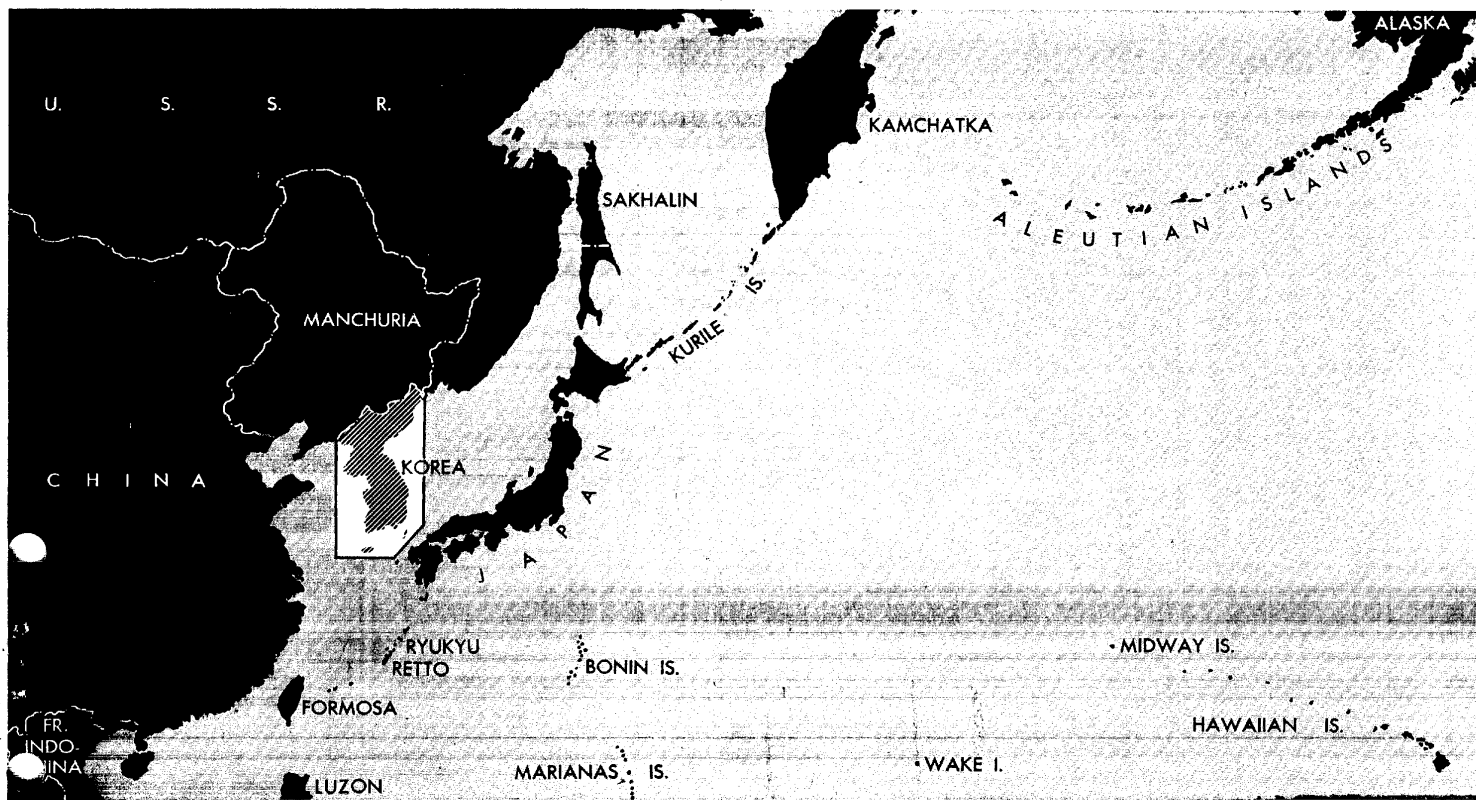
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CHAPTER I

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JOINT ARMY-NAVY INTELLIGENCE STUDY

OF

KOREA

(INCLUDING TSUSHIMA AND QUELPART)

BRIEF

APRIL 1945

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List of Effective Pages and Table of Contents, Chapter I (inside front cover)	Original	unnumbered ¹
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BRIEF

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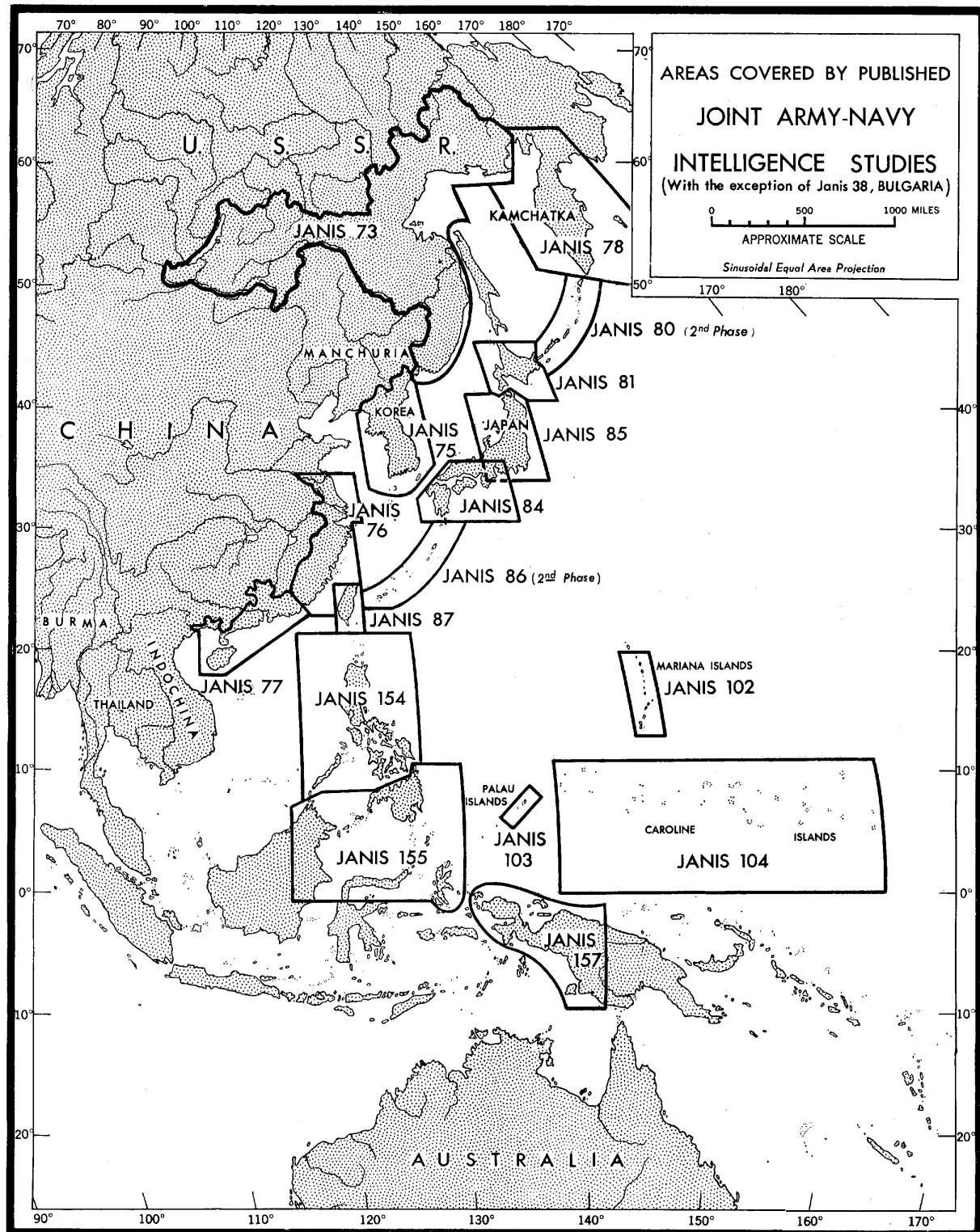
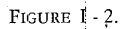


FIGURE I - 1.



Chapter I

Page I - 3

BRIEF

Foreword

The purpose of this study is to make available, subject to limitations of time and material, one publication containing all the necessary detailed topographic information upon which may be based a plan for military operations in Korea. The study is intended also to provide an organized presentation of material to be used as a base on which to plot later information obtained from aerial reconnaissance and other sources available in the field. Data available in Washington up to 1 March 1945 have been incorporated in the study. A list of principal sources will be found at the end of each chapter except Chapter I. Correct diacritical markings of place names are found in the Gazetteer, Chapter XV. Because of typographical difficulties, the breve was omitted over the Korean o and u in all other chapters.

To meet the varied requirements of users, the material is presented in two distinct patterns. Chapter I, entitled "Brief," is a condensation of the material presented in much greater detail in the succeeding chapters. It provides a "quick look," complementing the main body of the study.

This publication has been prepared from material contributed by a number of agencies of the United States Government, including the following: Aerology Section, Office of the Chief of Naval Operations; Assistant Chief of Air Staff, Intelligence; Board on Geographical Names; Coast and Geodetic Survey; Hydrographic Office; Joint Meteorological Committee; Military Intelligence Division; Office, Chief of Engineers (Army Map Service, Beach Erosion Board, Board of Engineers for Rivers and Harbors, Geological Survey); Office of Naval Intelligence; Office of Strategic Services; Office of the Surgeon General; Weather Division, Army Air Forces.

For convenience, contents have been made up in two volumes: Volume 1, text, and Volume 2, Plans Pouch. A table of contents will be found on the inside cover of each chapter. The text includes the following 15 chapters, all of which are "Confidential" except II, XI, and XV, which are "Restricted."

CHAPTER I	BRIEF
CHAPTER II	MILITARY GEOGRAPHY
CHAPTER III	OCEANOGRAPHY
CHAPTER IV	COASTS AND LANDING BEACHES
CHAPTER V	CLIMATE AND WEATHER
CHAPTER VI	PORT FACILITIES
CHAPTER VII	TRANSPORTATION AND TELECOMMUNICATIONS
CHAPTER VIII	CITIES AND TOWNS
CHAPTER IX	RESOURCES AND TRADE
CHAPTER X	PEOPLE AND GOVERNMENT
CHAPTER XI	HEALTH AND SANITATION
CHAPTER XII	DEFENSES
CHAPTER XIII	NAVAL FACILITIES
CHAPTER XIV	AIR FACILITIES
CHAPTER XV	GAZETTEER AND MAP APPRAISAL

FIGURE I - 1 shows the areas covered by this and previously published JANIS studies.

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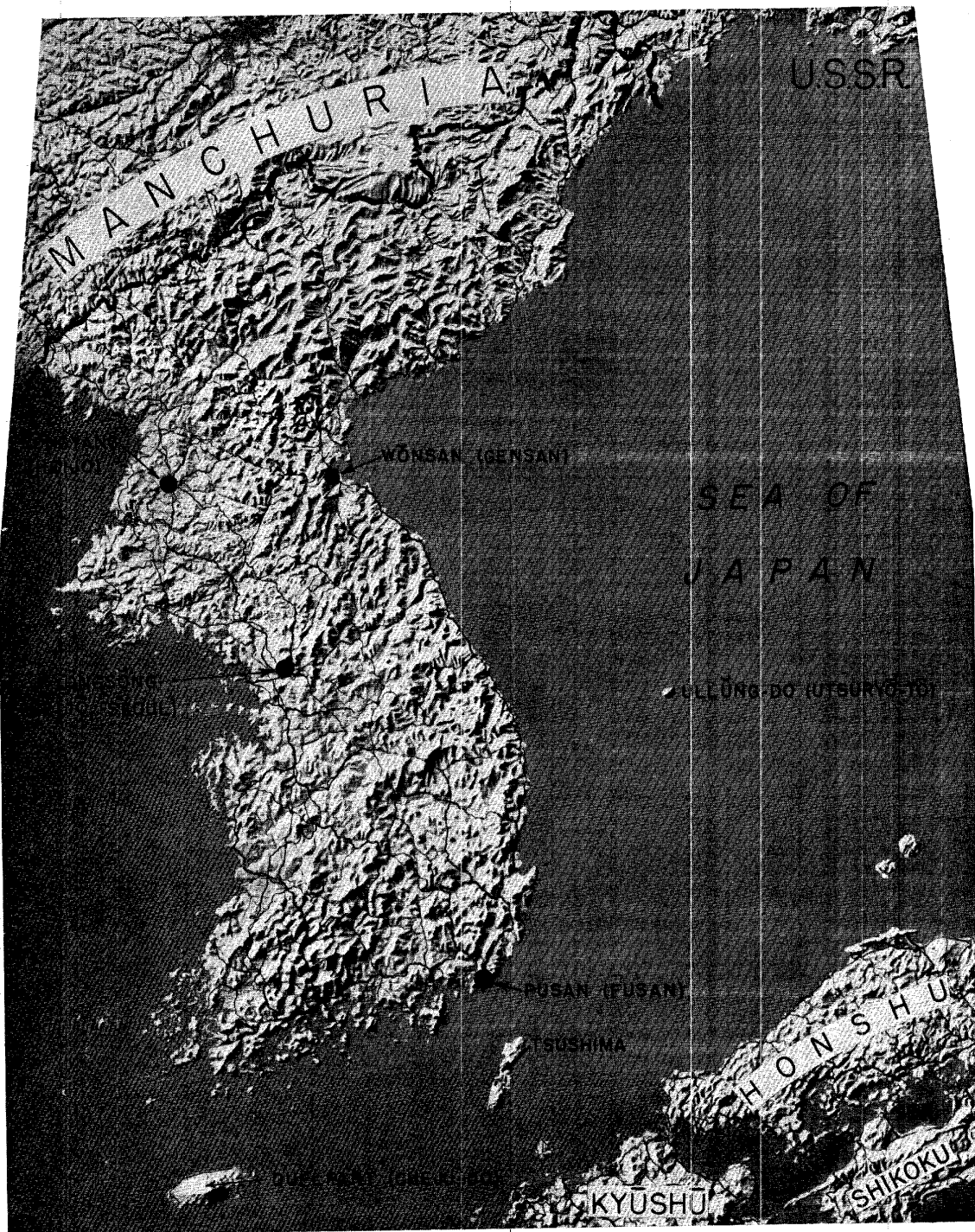


FIGURE I - 3. Korea.
Vertical view of model.

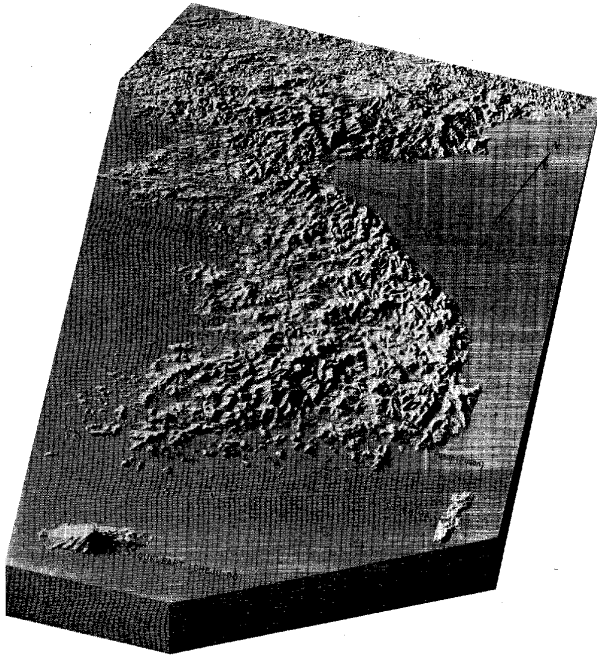


FIGURE I - 4. *Korea.*
Oblique view of model, looking northward.

1. Introduction

A. Position.

Korea (Chōsen) is a long peninsula extending southeastward from Manchuria (FIGURES I - 3 to I - 5). It lies in the midst of Japanese-held territory: Manchuria along the northwest border, China across the Yellow Sea to the west, and the main islands of Japan across the Sea of Japan and Korea Strait to the eastward (FIGURE I - 2). The only break in the Japanese encirclement is in the northeastern corner, where Korea adjoins the U. S. S. R. for a distance of about 10 miles. Vladivostok is about 80 miles distant from this corner of Korea.

Korea provides Japan with important amounts of food and raw materials, a strategic military supply base, and a link of railroads between Japan proper and her military forces on the Asiatic mainland.

B. Terrain.

The northern third of Korea is occupied by a mass of rough mountains separated from Manchuria by the deeply trenched valleys of the Amnok-kang and Tuman-gang (FIGURE I - 5). Southward from these mountains the Taebaek Range, a long barrier of lower mountains, extends to the end of the peninsula keeping close to the east coast.

Mountain and hill spurs branch from the Taebaek Range westward to the coast of the Yellow Sea. The principal lowlands of Korea lie between these mountain spurs. The lowland of the Nakdong-kang (river) opens upon the south coast, but all other large lowlands border the west coast. All the long rivers of Korea, except the Tuman-gang in the north, flow westward from the Taebaek Range and wind through the lowlands. The roughness of the mountains and the wetness of the lowlands with their large rivers and irrigated fields are serious hindrances to movement.

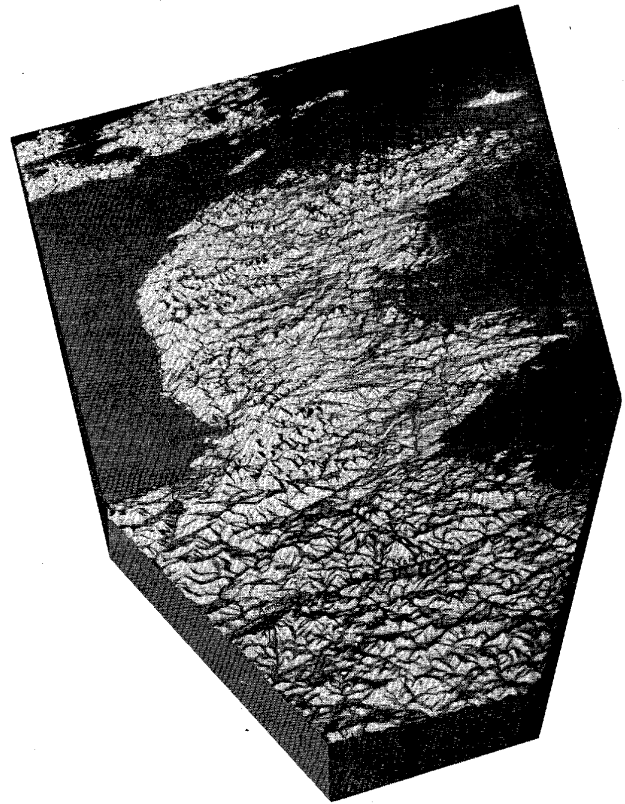


FIGURE I - 5. *Korea.*
Oblique view of model, looking southward.

The south and west coasts are highly irregular, with alternate beach-fringed lowlands and rocky headlands, and numerous offlying islands, rocks, reefs, and shoals. Broad drying mud flats and sand bars, and a large tidal range, add to the difficulty of approach along the west and south coasts. The largest islands are Tsushima (politically part of Kyūshū) and Cheju-do (Saishū-tō, Quelpart), in the Korea Strait.

In contrast to the west and south coasts, the east coast is fairly regular, with small beach-bordered pocket valleys separated from one another and from the interior by steep mountains with swift streams; approaches from the sea are relatively clear.

C. Climate.

Korea is hot and wet in summer, cold (below freezing) and fairly dry in winter. The climate of Kyongsong (Keijō, Seoul) about midway of the area, north and south, closely resembles that of Des Moines, Iowa, except that in summer Kyongsong receives about 3 times as much rainfall as Des Moines. Cross-country trafficability is best in fall and winter. Rivers in the northern half of Korea freeze in winter, but ice does not form in the harbors except in the northeast, where movement of small boats is sometimes hampered by ice; and in the northwest, where river ports, including Sinuiju (Shingishū) and Chinnamp'o, are closed by ice part of the winter. The seasonally reversing wind—northerly in winter, southerly in summer—affects shipping on windward coasts.

D. Economic regions.

The Korean population is concentrated chiefly in the lowlands of the west and south, which are utilized for intensive agriculture, especially paddy rice production. About $\frac{3}{4}$ of the people of Korea depend upon agriculture, and a considerable amount of rice, other food, and cotton is exported to Japan. Some cities of central Korea, especially the Kyongsong (Keijō, Seoul) - Inch'on (Jinsen) - Pū'yong (Fuhei) district have important metal-working industries.

Northern Korea, though less densely populated than the rest of the country, is the principal industrial region because of its large resources of hydroelectric power, iron and other ores, coal, and timber. The principal iron mines are at Musan (Mozan) in the far northeast. Coal and iron ore are exported in considerable quantities to Japan proper. Production of chemicals (the leading manufacture of Korea in terms of value), iron, and steel are important industries in the northeast.

E. Principal routes.

The most important artery of transportation in Korea is the double-track railroad running from Pusan in the southeast corner of the peninsula to the Manchurian border at Sinuiju - An-tung in the northwest corner, and thence to Mukden. This railroad links the chief lowlands and the three largest cities of Korea and provides rapid communication between Japan proper and Manchuria. The railroad has many vulnerable bridges. Several branches connect the main line of the railroad with ports on the west coast.

Another railroad skirts much of the coast of northeastern Korea, and connects with cross lines running into Manchuria. These cross lines have become very important for military traffic to Manchuria and for the development of resources and industries in northern Korea.

The rail systems of the west and the east coasts are connected with one another by two cross lines winding through the mountains. The most important of these lines runs southward from Wonsan (Genzan) to Kyongsong (Keijō, Seoul) traversing the mountains by way of a natural corridor; the other runs westward from Wonsan to P'yongyang (Heijō).

Korea does not have an extensive net of all-weather roads. The use of automobiles has never been widespread, and the roads have been laid out chiefly from the military viewpoint. The main road arteries form a great X intersecting at Kyongsong and extending to the four corners of the peninsula, one highway running from Pusan to Sinuiju, and the other from Mokp'o to Onsong (Onjō) by way of Wonsan. Some of the few hard-surfaced roads connect major cities with their nearby ports. Most of the motorable roads are made of macadam. Spring thaws, summer rains and floods, and, in the mountains, landslides, often impede traffic on ordinary roads.

Much Korean transport is handled by coastal shipping. Active trade with Japan proper is carried on through all major ports.

F. Important nuclei.

Eleven of the 15 Korean cities with population of more than 50,000, are situated on or adjoining the western and southern lowlands. The other 4 are on the northeast coast. Ch'ongjin, Najin, Wonsan, Pusan, Kyongsong, and Sinuiju - An-tung are particularly vital strategic centers.

(1) Central and northwestern centers.

By far the largest and most important city is Kyongsong (Keijō, Seoul), the capital of Korea and the only city with a population approaching one million. It is about 20 miles inland from the west coast about midway between the northern and southern ends of the coast, at the inner edge of a lowland. It is the principal railway and road hub of Korea and, together with its rapidly growing suburbs, manufactures railroad equipment and other heavy machinery. The port for Kyongsong is Inch'on (Chemulpo, Jinsen), fourth largest city of Korea, with important steel and machinery manufacturing.

P'yongyang (Heijō), second largest city of Korea, is another lowland city, about 120 miles northwest of Kyongsong. It is an industrial and railroad center, and has Korea's chief arsenal and army airbase. Its port, Chinnamp'o, has chemical and non-ferrous metallurgical industries, based upon the mineral and power resources of the northwestern region, and is the principal naval coal depot of Korea.

On the northwest border is the strategic city of Sinuiju (Shingishū) which, together with the larger city of An-tung across the border in Manchuria, forms a single urban complex. Two major bridges on the main railroad cross the Amnok-kang (Yalu River) here. Sinuiju is a center of lumbering, mining, and new industrial development. An ice-free port has recently been developed for this area at Dasado (Taedasa-do, Tashitō), on the coast just south of the mouth of the Amnok-kang (Yalu River).

(2) Southern centers.

In southern Korea the most important center is Pusan (Fusan), third largest city and most vital port of the country. It is the key transshipment point on the fastest water and land route from Japan proper to Manchuria. At Pusan the main Korean railroad meets the vital freight and passenger ferry from Shimonseki, Honshū. Pusan is also the center through which the principal concentration of cables connects Korea with Japan proper. The distance from Pusan to Shimonoseki across the Korea Strait is 120 miles. Pusan is the chief ship-building center of Korea, and has important munitions, iron and steel, and oil refining industries.

Sixty miles inland from Pusan is Taegu (Taikyū), the largest inland city of southern Korea. Taegu lies in the heart of the chief southward-facing lowland, and is an important political, textile, commercial, and transportation center.

Twenty miles west of Pusan is Chinhae (Chinkai), which has the principal naval base of Korea, the headquarters for the guard district covering the entire south and west coasts, and a major air depot. Chinhae has unlimited protected anchorage.

Still farther west is Yosu (Reisui), recently developed as a military and naval center and connected with the main rail system of western Korea.

The two large islands off the south coast of Korea have important military installations. Aso-wan (Tsushima Sound), in Tsushima, is fortified, and the minor naval base on Aso-wan may have been reestablished. Cheju-do (Saishū-tō, Quelpart) is important as an airbase between Japan and China.

In the southwestern part of the mainland the two chief ports are Mokp'o (Moppo) and Kunsan (Gunzan), both of which export rice from the Korean lowlands to Japan proper. Kwangju (Kōshū), a transportation center, is the principal inland city of the southwest.

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BRIEF

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(3) Northeastern centers.

The rapid development of the power and mineral resources of the area, and the increasing military importance of Manchuria and the Russian border region, have led to rapid recent development of cities in northeastern Korea. Six of the 10 principal ports of Korea are concentrated on this coast.

The 3 northernmost principal ports—Unggi (Yŭki), Najin (Rashin), and Ch'ongjin (Seishin)—have special military importance because of their direct rail connections with the Manchurian railroad center of T'u-men, just across the border from Korea. In addition, Unggi and Najin lie only about 10 and 20 miles, respectively, from the Russian border. Najin (Rashin), a very large port, has a naval base and major naval coal and oil depots, and is the headquarters for naval administration on the east coast. Ch'ongjin (Seishin), with a population of about 200,000, is the largest city of the east coast. Ch'ongjin has extensive traffic between Japan and Manchuria, is the outlet for iron ore from the great Musan mines, and has important new iron and steel industries.

Two other principal ports, Hungnam (Kōnan) and Wonsan (Genzan), lie on the northern and southern sides, respectively, of Tongjōson-man (Higashi-Chōsen-wan, Choson-haeman), the large gulf opposite the narrowest part of the Korean Peninsula. Hungnam (Kōnan) is the center of Korean manufacture of chemicals, including munitions. It is the largest producer of nitric acid, glycerine, sulphuric acid, and magnesium in the Japanese Empire. Wonsan (Genzan) is the east coast terminus of the rail and highway routes that lead through the mountains to Kyongsong and P'yongyang on the western lowlands. Wonsan has a harbor with unlimited anchorage, a naval base, a fuel oil and coal storage base, and the principal petroleum refineries of Korea.

G. People and government.

The Koreans are much like the Chinese in culture, but they have their own language. Since the annexation of Korea by Japan in 1910, the Japanese have controlled the government and the police. Japanese now constitute about 3% of the total population of Korea and 10% to 20% of the population of the cities. Though the Japanese police have eliminated open activity of independent Korean organizations such as labor unions and political parties, a strong spirit of resistance and a desire for independence continue to exist among the people. Guerrillas are active in the northern highlands, and underground resistance is organized in the cities.

2. Military Geography

The basic maps for use with this topic are FIGURES I - 15 to I - 20. In addition, PLANS 4, 5 to 34, and 48 to 51, in PLANS POUCH, together with ROUTE SUPPLEMENT FIGURES RS-5, RS-6, RS-11, RS-13, RS-16, RS-19, RS-20, and RS-21, in ROUTE SUPPLEMENT POUCH, comprise a medium-scale (mostly 1:250,000) topographic map of the entire area.

A. Relief.*(1) General character.*

Korea is a mountainous, S-shaped peninsula extending southward from Manchuria and Siberia toward Kyūshū (FIGURES

I-3 to I-5, and I-15 to I-18). From its northeastern border along the Tuman-gang due south to Pusan, Korea extends about 525 miles. Its width east - west varies from 125 to 200 miles, and its area is estimated at 85,000 square miles. The Korea Strait, which separates the peninsula from the main islands of Japan, is about 125 miles wide. Most of the northern boundary of Korea is formed by the deeply entrenched and winding Amnok (Yalu) and Tuman Rivers. Manchuria touches all this boundary except the easternmost 10 miles of the Tuman-gang where the Maritime Province of Siberia adjoins Korea.

Several large islands and hundreds of small islands lie off the peninsula. About 80 miles off the east coast is Ullung-do, a rugged, shield-shaped island. The 2 islands of Tsushima are about half way between Korea and Kyūshū. Cheju (Quelpart Island) lies 50 miles off the southwest corner of the peninsula. Hundreds of steep, rugged, small islands lie off the south and west coasts.

The east coast of Korea faces the Sea of Japan and is mostly steep and rugged, with small pocket lowlands separated by hills or mountainous promontories. The south coast faces the Korea Strait. This coast is deeply indented and very irregular. The west coast faces the Yellow Sea. It is mostly low, is greatly indented, and has a 1- to 5-mile-wide belt of mud flats exposed at low tide.

The relief pattern of Korea is dominated by the following highland elements: (1) A large mountain mass in the north and northeast, (2) a long nearly continuous mountain barrier extending southward from these northern highlands, and bordering the full length of the east coast, (3) several tributary ranges and spurs extending southwestward from the main east coast range.

Only a small part of Korea is lowland (FIGURE I - 17). The lowlands are similar to each other in many respects, but vary in size and have special characteristics depending upon position. They are found in 5 general locations on the peninsula: (1) Along the lower Tuman-gang and Amnok-kang Valleys in the north, (2) forming a series of small, disconnected pocket lowlands along the east coast, (3) in the Nakdong-gang Basin, inland from Pusan, (4) in a discontinuous belt along the south coast, (5) forming a series of 5 large and important lowlands along the western side of the peninsula. Each of the western lowlands is separated from its neighbor by a zone of mountains, hills, or ridges.

The mountain framework, because of its location and alignment, tends to restrict movement in any direction. The Northern Korean Highlands and the long, north - south-trending Taebaek Ranges make east - west, cross-peninsular, large-scale movement virtually impossible. The only significant east - west passageway extends between Wonsan and Seoul (Kyongsong, Keijō), but even this is locally narrow and steep (FIGURE I - 16). The tributary spurs, of which the Sobaek Range extending southwestward from the Taebaek Ranges is the most important, present a series of potential natural defensive positions at intervals of 10 to 30 miles across lines of north - south movement on the western side of Korea. Similarly, the steep ridges or hills separating successive small pocket lowlands at intervals of 1 to 6 miles along the east coast constitute a series of natural defensive positions across a line of north - south movement there. The winding rivers of western Korea, when at flood, also form obstacles to north - south movement. Such

rivers as the Kum, the Han, the Imjin, the Yesong, the Taedong, and the Ch'ongch'on have channels 200 to 2,000 yards wide (FIGURE I - 15).

(2) Regional divisions.

The terrain regions referred to in subsequent paragraphs are shown in FIGURES I - 15 to I - 17, and I - 19. The regions and subregions are:

1. Region 1. Lower Tuman-gang Valley.
2. Region 2. Eastern Coast Lowlands and Hills.
3. Region 3. Northern Korean Highlands.
 - Subregion 3a. Eastern Hills and Mountains.
 - Subregion 3b. Kaima Plateau.
 - Subregion 3c. Yangnim Range.
 - Subregion 3d. Pyongan-pukto Hills and Mountains.
4. Region 4. Northern Taebaek Range.
5. Region 5. Wonsan-Seoul Corridor.
6. Region 6. Southern Taebaek Range and Sobaek Range.
7. Region 7. Nakdong-gang Basin and Hills.
8. Region 8. Southern Coast Lowlands, Hills, and Islands.
9. Region 9. Island Approaches.
 - Subregion 9a. Ullung-do.
 - Subregion 9b. Tsushima.
 - Subregion 9c. Cheju-do.
10. Region 10. Western Lowlands and Hills.
 - Subregion 10a. Cholla-namdo and Cholla-pukto Hills.
 - Subregion 10b. Kum-gang Basin and Valley.
 - Subregion 10c. Ch'ungch'ong-namdo and Ch'ungch'ong-pukto Hills.
 - Subregion 10d. Han-gang Basin and Valleys.
 - Subregion 10e. Kyonggi-do Hills.
 - Subregion 10f. Imjin-gang and Yesong-gang Valleys.
 - Subregion 10g. Hwanghae-do Hills.
 - Subregion 10h. Taedong-gang Valley.
 - Subregion 10i. Pyongan-namdo Hills.
 - Subregion 10j. Ch'ongch'on-gang Valley.
 - Subregion 10k. Pyongan-pukto Hills.
11. Region 11. Lower Amnok-kang Valley.

A regional summary table of relief, drainage, vegetation, soil trafficability, and climate is included in PLAN 3.

(3) Mountains and hills (FIGURE I - 17).

The 3 major highland regions of Korea are (a) the northern mountain ranges; (b) the ranges of the peninsula including the Northern Taebaek Range, the Southern Taebaek Range, and its appendage, the Sobaek Range; and (c) the lower, hilly spurs, which extend southwestward from the main mountain systems. These hilly spurs separate the various basins and valleys of the southern and western coast.

(a) *Northern mountain ranges.* These mountains compose the Northern Korean Highlands (Region 3) and are a continuation of the mountains of southern Manchuria. Their drainage is mostly northward toward the Amnok and the Tuman, whose deeply entrenched and sinuous valleys form the greater part of the boundary with Manchuria. The highlands are largely rugged, steep, and rocky, but include areas of gently sloping upland, at elevations of 4,500 to 6,500 feet. These uplands, comprising the Kaima Plateau, are a conspicuous feature of the area southeast of Paektu-san. Although the undulating upper surfaces of the Kaima Plateau are favorable for movement, they are set apart by steep valley sides and are practically isolated. Except for these flattish uplands the Kaima Plateau is very unfavorable for movement. The easternmost and westernmost parts of the Northern Korean High-

lands have rolling to steep hills and mountains, generally 1,000 to 3,000 feet high, with winding, U-shaped valleys as much as a mile wide. Passes on principal routes are 1,600 to 2,300 feet high. These eastern and western extremities are generally more favorable for movement than the very broken Kaima Plateau and the very rugged Yangnim Range which lie between them. The Yangnim Range is the highest and most inaccessible portion of the Northern Korean Highlands Region. Summit elevations range from 5,000 to more than 8,000 feet; almost all slopes are steep; valleys are narrow and very winding. Passes on principal routes are 3,500 feet or more in elevation.

In general, the terrain in the Northern Korean Highlands is unfavorable for movement. The winding valleys offer only limited possibilities for movement and the hills and mountains are very difficult. Natural routes are largely concentrated in the eastern and western parts of the region.

(b) *Peninsular highlands.* The peninsular ranges include the Northern Taebaek and the Southern Taebaek with its largest appendage, the Sobaek Range. The Northern Taebaek Range is a southward extension of the Northern Korean Highlands. Here the ridges trend mostly north-south, but the valleys extend in all directions. The region is rugged, partly forested and well drained, but unfavorable for cross-country movement. The hills and ridges are generally 1,500 to 5,000 feet high, and are steep. Valleys are narrow, gorge-like, and extremely winding. In their upper reaches the larger westward-flowing rivers, such as the Ch'ongch'on, the Taedong, the Yesong, and the Imjin, flow in narrow, steep-sided valleys or gorges which provide no room for extensive movement or deployment. The hill and mountain slopes are very unfavorable to cross-country movement. No routes suitable for rapid, large-scale movement cross this region in any direction. Existing roads are narrow and winding, and cross steep passes 2,000 to 3,600 feet high. Separating the North and South Taebaek Ranges is the Wonsan-Seoul Corridor, the most favorable passage between the east and west coasts.

South of the corridor is the Southern Taebaek Range. This is a continuation of the Northern Taebaek Range and is similar in character—steep and rugged, with narrow, winding, gorge-like valleys. Summit elevations are generally 2,000 to 5,000 feet. Most of the ridges and valleys are aligned north-south, although the region as a whole trends northwest-southeast.

The Sobaek Range is a southwestward extension of the Southern Taebaek Range. It lies across the routes from Pusan to Seoul. Terrain at higher elevations in the Sobaek is rugged, like that of the Taebaek, but the average elevation is lower (2,500 feet) and a greater area has moderate slopes. The river valleys are wider, particularly in their lower reaches, but there is little flat land in the Taebaek or in the Sobaek; nearly all the surface is sloping. The small areas of flat land in the valleys are irregular in size and shape and are discontinuous.

In general, the highland terrain of the peninsula is unsuitable for cross-country movement. Steep, eroded slopes, and non-trafficable soils resulting from heavy summer rains, are unfavorable factors for movement in the lower hills. In the higher areas, cliffs, very steep slopes, and rugged terrain resulting from extensive erosion make cross-country operations almost impossible. Even on the flat valley floors, movement is ham-

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pered by the winding character of the streams, by floods, and by wet rice fields.

All east - west routes across the Southern Taebaek are steep, narrow, winding, and cross passes at least 1,200 feet high. These routes probably are unsuitable for heavy, two-way traffic. Three of the main north - south routes of Korea cross the Soback Range. All three are locally narrow and winding, and cross passes 330 to 1,600 feet high.

(c) *Hill country.* The southwestward-trending hilly spurs extending from the main mountains toward the south and west coasts separate the various southern and western lowlands, and are discussed below.

(4) Lowlands (FIGURE I - 17).

Korea's lowlands are relatively small and most of them are nearly surrounded by hills and mountains. The largest and most productive of them are found in the west and south, and are associated with the larger rivers, such as the Taedong, the Han, the Kum, and the Nakdong. Each lowland is flat or gently sloping, intensively cultivated, and drained by a main stream and smaller tributaries. Many lowlands are protected from flood waters by dikes. The largest lowlands are 25 to 30 miles wide and may extend 30 to 50 miles inland; the smallest are about a mile wide and extend 3 to 5 miles inland.

(a) *Northern border lowlands.* Both the Lower Tuman Valley (Region 1) on the northeastern border, and the Lower Amnok-kang Valley (Region 11) on the northwestern border are winding, entrenched, steep-sided, and flanked by hills and mountains. Neither lowland provides continuously favorable terrain for movement inland. Existing routes are successively close to the rivers and several miles away, among the hills. These regions have military importance because of their situation along the Siberian and Manchurian borders.

(b) *Eastern coastal lowlands.* The Eastern Coast Lowlands and Hills (Region 2) includes a series of semi-isolated pockets near the mouths of streams. These lowlands are generally flat, intensively cultivated, 1 to 6 miles broad, and extend 3 to 8 miles inland. Along the shore they generally have a cobbly beach, backed by dunes or a lagoon. On the land side they are surrounded by steep, partly forested hills or mountains. Each lowland pocket narrows inland into a winding, steep-sided valley. The largest and most important of these is between Hamhung and Wonsan and leads inland to the Wonsan-Seoul Corridor.

(c) *Southern interior lowlands.* The Nakdong-gang Basin (Region 7) in the southeastern part of Korea, contains an extensive area of lowland. This lowland borders both sides of the Nakdong-gang and of its major tributaries, and varies in width from a few yards to 8 to 10 miles. It provides a low but very winding route 125 miles into the peninsula from the Nakdong delta near Pusan. Dikes and levees up to 15 to 20 feet high protect the cultivated parts of the valley from flood waters. The uncultivated parts are covered with sand, cobbles, or boulders and are nearly bare of vegetation. The cultivated parts produce a variety of crops, chiefly rice. Rolling, much eroded hills overlook all of this lowland. Above the hills, steep mountains, 3,000 to 4,000 feet high, rise as conspicuous landmarks. Lowland terrain conditions favor cross-country movement except on the wet rice fields and during wet summer weather. Existing routes are not steep, but are very wind-

ing. The principal Pusan-Seoul road and rail routes cross the region.

(d) *Southern coastal lowlands.* The Southern Coast Lowlands, Hills, and Islands (Region 8) includes several small lowlands, most of which are situated at the heads of bays. These lowlands trend mostly north - south, occupying the valleys of the Somjin-gang and smaller streams to the east and west. They are 1 to 5 miles wide and 3 to 8 miles long. Numerous small, flat lowland areas are planted almost entirely to rice, but some low areas are barren river flood plains, or are planted to dry crops.

Low, steep, gullied hills separate the numerous small lowland areas. On the south, winding, rugged peninsulas enclose the bays, and hundreds of rugged islands dot the bays and guard the coast to a distance of 50 miles offshore. On the north, west, and east, steep, gullied hills and mountains surround the lowlands and confine the routes between them. Some of the larger bays at whose heads the lowlands begin are Chinhae-man, Kwangyang-man, and Tungnyang-man. Among the largest islands offshore are Koje-do, off Chinhae-man (Masan); Namhae-do, near Kwangyang-man (Yosu); and Chin-do, near Mokp'o. The most favorable areas for cross-country movement are those lowlands which are not in rice, and the lower hills. The rice paddies are unfavorable for movement when wet, and most of the hills are gullied and steep. Existing road and rail routes lead mostly northward toward Seoul. The roadways are not steep but are very winding. The east - west, coastal road follows a devious route, skirting the shore, turning inland to avoid hills, crossing some lowlands but avoiding rice fields, and crossing passes less than 1,000 feet high.

(e) *Western lowlands.* The 5 major lowlands in the Western Lowlands and Hills (Region 10) are the most extensive in Korea. They trend mostly northeast - southwest. The largest are 25 to 30 miles wide and extend 30 to 50 miles inland. Rolling and steep hills and ridges separate the various lowlands from each other and constitute potential natural defensive positions blocking north - south movement. The lower, broader coastal basin sections of the lowlands are mostly bordered by hills even on the sea side, and generally have restricted outlets to the coast. The slightly higher, narrower, winding, valley sections of the lowlands are overlooked on both sides by eroded hills and ridges which extend inland to the major ranges. The chief westward-flowing rivers, such as the Kum, Han, Imjin, Yesong, Taedong, and Ch'ongch'on, also form natural barriers across lines of north - south movement.

From south to north, the lowlands have been designated according to the principal rivers, the Kum, the Han, the combined Imjin and Yesong, the Taedong, and the Ch'ongch'on. The hills and ridges separating the lowlands have been named according to the provinces where these hills are principally located. The lowlands have the following characteristics: (1) They are moderately to extremely winding, and are drained by very sinuous streams; (2) near the sea they become flatter and broader (10 to 30 miles) with extensive rice cultivation, canals, and ditches; (3) the principal rivers empty into estuaries 1 to 4 miles wide, where, at low tide, 1 to 5 miles of slimy mud flats are exposed; (4) the river banks are alternately steep and gentle; the lower hills are locally terraced and cultivated; the steeper and higher hills are gullied by erosion,

and are partly covered with grass, scrub pine, and scattered trees; (5) the lowland areas are intensively cultivated; rice is the principal crop and is grown chiefly in the lower parts; dikes, some of which are 15 to 20 feet high, protect the cultivated fields from flood waters; (6) hills or ridges overlook every part of these lowlands; concealment is generally lacking in the lowlands as well as in the hills; (7) the most favorable routes for cross-country movement on these lowlands are in or near the low, rolling hill sections; these routes are very winding, but have few bottlenecks, and generally have ample room for deployment.

The principal north - south road and rail routes and important east - west routes join in the Han Valley at Seoul, which is the transportation hub of the peninsula. From this place road and rail routes go northeast to Wonsan, south-east to Pusan, south to Taejon, west to Inch'on, and north-west to P'yongyang and Sinuiju. Taejon, in the Kum Valley, and P'yongyang, in the Taedong Valley, are also situated at road and rail junctions. From each of these cities routes lead north - south and east - west.

(f) *Wonsan - Seoul Corridor.* The Wonsan - Seoul Corridor trends nearly north - south through the east coast mountains and separates the Northern Taebaek Range from the Southern Taebaek Range. It is followed by a road and rail route about 60 miles long. Near the northern and southern ends of the corridor, the rail route follows gently sloping valleys a mile or more in width. The middle 12 miles of the rail route is in a narrow gorge or depression. Highest elevations on the rail route are about 2,000 feet. The road route is longer and has a maximum elevation of about 2,300 feet. The northern and southern parts of the road route are similar to the rail route, but the middle 30 miles goes through alternately wide and narrow stream valleys, bordered by steep hills. Both routes have a steep portion a mile or two long. Although the corridor is not entirely suitable for rapid, large-scale movement, it offers less difficulty than other east - west routes.

B. Drainage and water supply (FIGURES I - 15 to I - 17).

Korea is well watered and well drained. It has an intricate drainage network but relatively few lakes. Marshes are small and of only local significance except in coastal tidal areas.

(1) Rivers.

There are nine principal river systems, each of which has an extensive drainage basin.

(a) *Major rivers.* The Tuman-gang is the only major eastward-flowing stream of Korea. It drains most of north-eastern Korea and flows into the Sea of Japan. Its lower course is navigable by lighter craft for about 50 miles. The lowest 10 miles of its course separates the Maritime Province of Siberia from Korea. Its upper section forms part of the boundary between Korea and Manchuria.

The Naktong-gang and the Somjin-gang flow southward and are the principal rivers in southern Korea. The Naktong-gang is navigable by light craft for about 200 miles.

On the west side of the Korean Peninsula are the Yongsan-gang, Kum-gang, Han-gang, Taedong-gang and the Ch'ong-ch'on-gang systems, all of which drain into the Yellow Sea. These streams are comparatively long, very sinuous, and have extensive tidal flats at their mouths.

In the northwest, the Amnok-kang forms part of the boundary between Manchuria and Korea and flows southwestward into the Yellow Sea. The Amnok-kang is 500 miles long and is Korea's longest river. It and its tributaries have cut deeply entrenched, narrow, winding valleys with relatively flat bottoms. Its main channel is encumbered by many islands and sand banks in the lower course and by numerous upstream rapids. The river is navigable by small, light craft, such as motor boats, for about 350 miles up from its mouth.

(b) *River characteristics.* Except for the Amnok, Korean rivers are short (100 to 350 miles). Generally, they are swift in their upper courses, slow in their middle reaches, and excepting those along the eastern coast, have built up fairly large flood plains. With minor exceptions the pattern of drainage trends with the relief of the peninsula. A common characteristic is the very large amount of debris carried by the east coast streams and in the upper reaches of all streams. This results in boulder-filled channels in the swift sections and sediment-loaded water throughout. Few of the rivers could be used as waterways but their valleys are important as routes for movement.

The main rivers range in width from 4 miles (at the mouth of the Amnok-kang) to about 50 yards (in the narrow gorges of the upper Tuman-gang). Normally, most of the major rivers are $\frac{1}{4}$ to $\frac{1}{2}$ mile wide at many points. Many smaller streams range between 100 and 200 yards in width.

Most Korean streams are relatively shallow. Many of the river courses are fordable during low-water season (November to March). Their average normal depth is 2 to 3 feet in their upper reaches and about 6 to 9 feet in their lower courses. During high-water season many of the streams become raging torrents, and flash floods occur. The amount of debris transported is enormous; the rivers raise their stream beds and flood the valley bottoms downstream. At such times flood waters 5 to 15 feet deep may inundate the rice fields. During highwater season the rivers would be a major barrier to movement.

In their lower courses, especially near the west and south coasts, the streams have low banks. The banks of the lower Naktong-gang and of the streams along the west coast are 10 to 15 feet high. Many of the upper courses of the streams flow through narrow valleys with cliffs 30 to 50 or more feet high. Numerous rock gorges of the upper Amnok-kang and Tuman-gang (and of the short streams along the east coast) are more than 100 feet deep. Generally, the river banks of the lowland areas are of sand and gravel and are gradual in slope. Many of the banks have long barren stretches interrupted by patches of grass and thickets. Along many of the stream banks are large boulders and rocks moved downstream during high water.

The rivers in northern Korea are frozen from 3 to 4 months annually. Those in the central sections of the peninsula are frozen from 2 to 3 months. During winter many of the streams and irrigation canals in the Western Lowlands are frozen and can be crossed by foot troops. The rivers and streams of southern Korea, however, are open all year.

(2) Lakes and marshes.

There are no large lakes or ponds in the peninsula. Two large reservoirs have been constructed in the Northern Korean Highlands, and the very large Sup'ung Reservoir is in the

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Amnok Valley. There are many small ponds and lagoons scattered along the east coast, but these are mainly of only local significance. Small marsh areas are numerous locally, especially along the tidal river mouths of the west and south coasts. Generally, they can be by-passed and are only minor barriers to movement.

(3) *Water supply.*

Korea has a plentiful supply of water in most sections of the peninsula. It is not safe for consumption and should be treated before use. The water table is high along the coast most of the year and much of the water tastes brackish. Many of the larger towns have water supply systems but most of the rural population obtains its supply from wells. Owing to the lack of vegetative cover, and to mountainous terrain, runoff is rapid. The amount of water available varies with the season and location. Rainfall normally averages 35 to 40 inches annually. The heaviest fall occurs in the southeast, south, and west; the north and northeast are slightly drier and their rainfall is less variable. Abundant winter snows in the mountains help maintain summer runoff to lowland areas. Fall and winter are the dry periods.

C. Soil trafficability (FIGURE I - 18).

Soil trafficability is the capacity of soils to support vehicles moving cross country, or on unimproved roads or trails. Soil trafficability is determined by soil type (textural grade, organic matter content, and other profile features), topography, vegetation, and weather factors. In this area the important weather factors are precipitation (duration, intensity, and character); temperature (as it affects evaporation, plant growth, and the freezing and thawing of soil); and wind, cloud cover, and humidity, which affect evaporation of soil moisture.

(1) *Terrain and soil trafficability.*

By far the greater part of Korea is rough or mountainous and therefore unfavorable for cross-country movement of wheeled vehicles, regardless of soil or weather conditions. Where topography is favorable in valley and coastal lowlands, much of the land is planted to wet rice. Rice paddy lands are particularly numerous in southwestern Korea where great irrigation projects have extended a complicated network of canals over the valley and coastal plains. The paddy lands are flooded and nontrafficable from early June until the harvest during October or early November. After the harvest most of the paddy fields north of 37° N are fallow, but canals (which in many places are raised above the general level of the fields) and irrigation ditches remain serious obstacles to cross-country movement. South of 37° N, winter crops are raised in some fields on ridges about 1 foot high and 2 feet wide, spaced about 2½ feet apart; these ridges are additional obstacles to cross-country movement. The areas in which mountain lands and lowland rice paddy land predominate are shown on the soil trafficability map (FIGURE I - 18).

In nonpaddy areas of favorable topography, soil drainage characteristics and weather factors are particularly important in determining the feasibility, route, and rate of cross-country vehicular movement. In such areas medium-textured soils (loams), many of which are stony or gravelly, are the most common textural type. Where these soils occur on valley terraces or hill slopes, they remain trafficable during nonpersistent

light or medium rains. During heavy or persistent rains, however, they become slippery and muddy and may mire vehicles locally. Their normal trafficability is regained rapidly after periods of rain. Loams occurring in lowland areas will mire vehicles almost everywhere during heavy or persistent rains, dry rather slowly, and are locally subject to flooding by stream overflow.

Fine-textured soils (clay loams and clays) also have widespread distribution in valley lowlands, on terraces and low hill slopes. The clay soils are slippery and muddy when wet, and, other factors being equal, they require a longer period than do loams to regain trafficability after periods of rain. In northernmost Korea, the clays are frequently peaty types which hold moisture and afford poor trafficability except when deeply frozen.

Coarse-textured (sandy and gravelly) soils afford the most favorable all-weather trafficability conditions. Where these soils occur on beaches or narrow coastal strips, they are trafficable at most places regardless of weather conditions. The tides along the western and southern coasts range up to 30 feet and extensive coastal flats are exposed at low tide. Where these flats are sandy, they may support light traffic, but trafficability deteriorates rapidly with continuous passage of vehicles. The coarse-textured soils in inland areas are trafficable at most places except during heavy rains or following persistent rainy periods. They are subject to local flooding in stream valleys.

The soil trafficability map (FIGURE I - 18) indicates in as much detail as is possible on such a small scale, the areas where the different soil types predominate. The legend is self-explanatory insofar as it indicates the relative trafficability of the different soil types in their natural state. Caution is urged in the use of the map, however, as it shows general regional contrasts only, rather than detailed information for any one place.

(2) *Weather and soil trafficability.*

In Korea as a whole, the most favorable period for the cross-country movement of wheeled vehicles is during late September, October, and early November. During this period, precipitation is generally light and infrequent at most places, and paddy lands are drained for harvest. Precipitation is further decreased, both in amount and frequency, for the period from late November through February, but there are important regional contrasts in trafficability. In coastal lowland areas south of 37° N, where a snow cover seldom persists, general trafficability may be better during winter than during the fall. Shallow soil freezing may occur for a few days at a time but the periods of thaw which follow do not seriously reduce trafficability.

Northward from 37° N, winter trafficability for wheeled vehicles becomes less favorable because of a more persistent snow cover. There are few data on the depth of snow, but, in coastal regions, it probably seldom exceeds a foot on level lowlands. In northwestern Korea, several feet of snow are common in drifts in inland valleys and on westward slopes. Soil freezing is usually persistent from December through February in inland areas north of 37° N, and is probably deep enough to aid vehicular movement where the snow cover is light or absent. In coastal areas soil freezing is less persistent, and periods of surface thaw cause poor trafficability during the winter. Most streams and rivers north of 38° N freeze over

during late November or December in a normal year, and the ice will probably support vehicles of light and medium weight at most places during January and February.

During March and April the soil is often saturated, and trafficability is generally poor. Soil moisture provided by melting snows and thawing soil drains slowly, because of the disruption of normal soil drainage channels by the winter freezing. Stream ice also breaks up at this time. Trafficability conditions are much more favorable in southern Korea than in northern Korea during this period.

During May and early June rains are frequent but light at most places; although the lowland soils and clay soils are frequently slippery and muddy, the soils with better drainage properties are usually trafficable.

During the period from late June through early September, heavy and persistent rains produce periods of widespread poor trafficability. A large proportion of the annual precipitation falls during this period which is the least favorable, in most of the area, for cross-country movement of wheeled vehicles.

Additional details concerning the climate of each terrain region are included in PLAN 3.

D. Vegetation (FIGURE I - 19 and PLAN 3).

The most significant features of Korea's vegetation pattern are the treeless, grass-clad hills and mountains which are found almost everywhere throughout the peninsula. Low scrub pine is scattered over mountain slopes. Cultivated areas are concentrated in the valleys. Some small local areas have been reforested. Only in sections of the Northern Korean Highlands and within large monastery domains in the Southern Taebaek Range, has the forest been little disturbed. There, large native forests remain. These original forests are the exceptions, for in more than $\frac{2}{3}$ of the whole country the natural tree growth has been destroyed. Where no cultivation is attempted and in crop areas that have been abandoned, coarse grasses, shrubs, and scrub pine dominate. Wood is the chief fuel in Korea; the trees and shrubs are hacked and maimed annually to supply firewood. As a result, the forest is most seriously depleted in areas of the most dense population. Tree types are similar to those of the New England States. Such trees as pine, fir, spruce, oak, birch, and maple are most common.

There are 5 major vegetation types in Korea. There are (1) the mixed deciduous* broadleaf and coniferous forest, (2) deciduous broadleaf forest, (3) cultivated area, (4) barren sections, and (5) marsh lands. Grasslands are associated with all types.

(1) *Mixed deciduous broadleaf and coniferous forest.*

The mixed forest includes almost $\frac{3}{4}$ of the forested area of Korea. Pine and fir are the two most common coniferous trees in this forest. Red pine grows in all parts of Korea except on the highest mountains and in the cold northern interior. Oak and birch are the common broadleaf trees. Most of the mixed forest has been cut over at least once, and the present trees are second growth. Much is bush forest of low quality. In the Yangnim Mountains of the Northern Korean Highlands, and in the Southern Taebaek Range some red pines are 75 feet tall and 3 to 4 feet in diameter. In the mixed forest, flat-leaf spruce, Korean fir, and nut pine may

be from 80 to 120 feet tall and from 3 to 5 feet thick. Oaks and birches are sometimes 50 to 60 feet tall and from 2 to 3 feet in diameter. Within the repeatedly cut-over sections of the region, these trees are much smaller. In some mountain sections a gradual transition from mixed forest to pure coniferous forest occurs, usually at between 4,000 to 5,000 feet elevation. Coniferous forests predominate on the northern slopes of Cheju-do, and on other high mountains. There are few mountains that extend above the tree limit. The important exception is Paektu-san. The trees are low and deformed near the upper limit of tree growth. In the mixed forests of the north, tree growth ceases at an elevation of about 6,000 feet. In the extreme southwestern part of the peninsula and on Cheju-do there is, below the mixed forest zone, a narrow strip of broadleaf evergreen forest including bamboo.

Generally, the undergrowth in the mixed forests is only moderately dense. It varies with the stage of forest development in any given locality. In the secondary forest of pine, fir, oaks and maples on the plateau of the Kanan-san (Region 4: Northern Taebaek Range) at an elevation of 4,800 feet, the forest is so thick that it may require $1\frac{1}{2}$ hours to go 1,500 feet. In older forests, there is an abundance of tree trunks and low limbs covered with vines. Such a forest surrounds Paektu-san for a considerable distance. Generally, passability increases with altitude. The coniferous forests of red pine are easier to penetrate than the mixed forest at lower elevations. The extensive larch forests of northeastern Korea are relatively clear of underbrush. (Larch is a deciduous conifer.)

The summits of higher mountains are covered with alpine shrubs, such as creeping pine, dwarf juniper, and dwarf willow in great variety.

(2) *Broadleaf forest.*

Broadleaf forests are most extensive in the northwestern part of the peninsula. Smaller areas parallel the northeast coast and are scattered throughout the Northern and the Southern Taebaek Ranges. Oak, birch, maple, aspen, willow, poplar, and elm are the most common broadleaf trees. Among the largest ones in the natural forest are the Mongolian Oak which may be about 60 feet tall, and 2 to 3 feet thick. A common species of birch sometimes grows to about the same size. The small-leaf elm may develop to about 75 feet in height and 3 to 5 feet in thickness. Forests of these trees are most common to steep, rocky mountains unsuited to agriculture, where the soil is poor and there is little settlement nearby. In general, broadleaf trees of Korea are not large when compared with similar species in forests in America, Europe or Japan. In contrast to the mixed forests, the broadleaf forests have a dense undergrowth. Shrubs and vines grow in abundance. Flowering species include azalea, rose, magnolia, honeysuckle, lilac, forsythia, and spiraea.

(3) *Cultivated areas.*

Approximately 20 percent of the 85,000 square mile area of Korea is cultivated. Korea is a land of varied climate, and correspondingly varied crops and crop practices. In winter the fields of southern Korea are green with barley or other grains while snow lies deep in the northern interior.

The cultivated areas have their largest extent in the Western Lowlands and Hills (Region 10), but the entire peninsula is intensively cultivated wherever possible. In all the more acces-

* Deciduous trees are those that lose their leaves in winter.

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sible valleys, slopes, and plateaus the most fertile soils have been brought under cultivation. Paddy rice is by far the principal crop and occupies $\frac{1}{3}$ of all the cultivated land. Other crops, in addition to various small grains, include soy beans, potatoes, corn, grain sorghum, cotton, fruits, low growing vegetables, and ginseng. From North P'yongan to South Cholla Provinces, the populous centers are in the wide, intensively cultivated valleys. In the lower mountain regions, patchy agriculture of wheat, millet, and barley predominates, and even in a few of the mountain valleys rice cultivation is attempted.

Cultivation in Korea is divided into two essentially different types approximately along the 37th parallel of north latitude. To the south, winter crops are grown on the rice fields. To the north, there is no double cropping. Depending on the region and locality, rice is generally planted in seed beds in April and transplanted into the fields in early June. Harvesting occurs during October. In the south, where fields are used for double cropping, the rice fields are replanted in October to another crop, such as beans or grain, which is harvested usually in June, and the field is then replanted with rice. Fields where double cropping does not occur remain idle during the winter season. There is more irrigation in the south than elsewhere.

Much of the cultivation in the mountainous regions is characterized by cultivated lands cleared by fire, called *kaden* (literally fire fields). Permanently cultivated fire fields extend up to elevations of 4,000 to 5,000 feet and are found even on steep slopes. They are most extensive in the Northern Korean Highlands and on the forested slopes of mountains marginal to lowlands. The burned-over areas are rectangular in shape. Generally, more forest burns than is needed. Stumps are left standing and are from 3 to 9 feet high. These tree stumps and tree trunks lie between the rows of cultivated plants. In winter the fire-cleared fields stand out as white spots on a gray background; in spring, brown on a green background. In the summer and fall the colors of the field will depend on the crop and stage of advancement, bright green, greenish-white, yellow, yellowish-brown, or wine-red. After a few years the field is abandoned and becomes covered with grass, bushes, and weeds. If the soil has not been eroded too much, a poor growth of secondary forest may cover the field.

(4) Barren sections.

Areas lacking a vegetative cover are found throughout Korea, particularly in the Western Lowlands and Hills (Region 10) and in the Nakdong Basin and Hills (Region 7). These barren areas are scattered along the valley flood plains, often interrupted only by patches of grass. In places, the barren sections may extend along the rivers for several miles. In other areas they are small, and intermingled with scattered trees or irregular cultivated fields. There are also numerous barren rock ledges and outcrops along the steep and narrow valley sides and on the steep mountain slopes.

(5) Marshlands.

There are many marsh and swamp areas throughout the peninsula. They are most numerous near the tidal river mouths along the west and south coasts, but do not include the extensive tidal flats of the west coast. Small in extent, they could usually be by-passed. Two of the largest marsh areas are near the Pujon and Changjin Reservoirs in the North Korean Highlands (Region 3).

(6) Effect of vegetation on operations.

In general, relief interposes much greater hindrances to movement than does vegetation. In forested areas, the foliage usually offers good concealment. Numerous sections of the peninsula can be penetrated without encountering dense underbrush. *Kaden*, or fire fields, numerous stumps and high tree trunks offer partial concealment for small groups of men. In cultivated areas, most crops are low growing, and excepting the wet rice fields, in western and southern Korea offer no hindrance to cross-country movement. In the western and southern coastal regions, wood for fuel or construction purposes would be difficult to obtain.

E. Significant areas (FIGURE I - 20).

Six areas in Korea have particular significance, in that they are situated at or near a natural passageway, through a natural barrier, or a junction of main routes. Control of these areas is probably essential to success of military operations in their vicinity. These areas are as follows:

1. Northeastern Korea, especially Ch'ongjin, Najin, and Unggi.
2. Wonsan area.
3. Wonsan - Seoul Corridor.
4. Pusan area.
5. Seoul (Kyongsong) area.
6. Sinuiju - An-tung area.

F. Routes to significant areas (FIGURE I - 20).

The two chief routes of Korea are:

1. Pusan to An-tung—approximately 550 miles.
2. Seoul to Tu-men—approximately 560 miles via coastal branch, 510 miles via inland branch (Hoeryong). This route branches from the Pusan - An-tung route at Seoul.

There are several alternate routes. One of these extends from Chonui to Mokp'o, at the southwestern extremity of the peninsula. Other alternate routes are:

- Taegu to Suwon, running east of Route 1.
- P'yongyang to Wonsan, connecting Routes 1 and 2.
- Anju to Man'ojin, an alternate approach to Manchuria from Route 1.

The chief routes and alternate routes named above are described in considerable detail in the ROUTE SUPPLEMENT. In addition to these routes or comprising parts of them, are numerous regional routes. These are shown in FIGURE I - 15 and are described in Topic 22 of Chapter II.

3. Oceanography

The waters of Korea are characterized by: (1) moderate to large tides on the south and west coasts, (2) strong tidal currents at times, and (3) in certain areas thin ice and slush which may occasionally become a hindrance to navigation.

A. Regional considerations.

Along the east coast of Korea the tidal range is small, and the daily variation in water level due to the weather is often greater than that caused by the tide. Along the south coast there is a mean tidal range of 3 to 8 feet, with tropic tidal

ranges as great as 11.5 feet. Along the west coast and among the offshore islands, the mean range varies from 2 to 21 feet, with a maximum at springs of 27.5 feet. Along the shores of Cheju-do (Saishū-tō, Quelpart) there is a mean range of 2.5 to 5.5 feet and a spring maximum of 7.5 feet. At Tsushima the mean range is 3 to 5 feet, and the spring maximum is 6.5 feet. The tides are semidiurnal, but there is usually a diurnal inequality when the moon is near its north or south declination.

The tidal currents are weak and irregular off the east coast, but they are often strong in the passes between the islands off the south and west coasts. Moderate tidal currents are experienced near Cheju-do (Saishū-tō, Quelpart) and Tsushima. The tidal currents are semidiurnal in character but, like the tides, they may have a noticeable diurnal inequality when the moon is near its north or south declination.

The oceanic currents are important only along the south coast and the southern part of the east coast of Korea where the oceanic drift flows eastward north of Cheju-do (Saishū-tō, Quelpart), northeastward through Korea Strait, and finally northward parallel to the east coast of Korea. This drift has an average velocity as high as 15 miles per day.

Off the east coast of Korea *sand* and *sand and mud* occur in most of the bays and coves with *rock* between the bays and off headlands. Seaward the shelf is usually *mud*, but in the south part and off the south coast, *mud* and *sand and mud* grade into *sand* in the middle of Korea Strait and in the Yellow Sea. Off the west coast, *rock* predominates in the southern part, but it is replaced by *sand* and *sand and mud* farther north.

B. Seasonal considerations.

Along the east coast of Korea there is a monthly variation in water level of more than 1 foot on the average. The water is lowest in April and highest in August.

Low seas are most prevalent from May through August, and high seas are commonest from October through March. Seas from north or northwest prevail from November through March and from southwest or south from May through August. Swell greater than 6 feet in height is improbable at any time in the Yellow Sea, but off the east coast of Korea swell 8 to 10 feet high may occur on 2 to 4 days per month from September through February.

The mean sea surface temperature varies from 36° to 60° F. in winter and from 70° to 80° F. in summer. Extremes of 31° and 86° F. have been recorded in this area. Thin ice forms in some ports on the east coast of Korea for as long as 4 months during the year, and thin ice and slush, which may obstruct navigation, sometimes occur off the west coast late in January and early in February. The mean temperature of the water is 1° to 9° F. warmer than that of the air from September through May and 1° to 5° F. colder during the remainder of the year.

Average echo ranges on a submarine at periscope depth vary from 500 yards in summer to 2,750 yards in winter; in spring and fall average ranges are usually less than 1,000 yards. The best depth for evasion for a submarine is at periscope depth in spring, summer, and fall; in winter, ranges are approximately the same at all depths.

4. Coasts and Landing Beaches

(FIGURE I - 21)

A. East coast.

Approaches to the east coast of Korea, between the mouth of the Tuman-gang (Tōman-kō or Tuman Ula) and Sungdumal (Yōtō-matsu or Harito Kutsu), are mainly clear; there are only a few small off-lying islands and shoals. Bottom gradients commonly range from steep to moderate except for the southernmost 40 miles, where they are more gradual. Most of the bottom consists of mud and sand with occasional rocky patches; sand predominates in most of the bays and coves.

The coast is fairly regular; it consists of low, level sandy stretches alternating with stretches of slopes and cliffs. Where the low, level stretches are closely spaced, wide beaches are almost continuous, but along the mountainous sections beaches mostly are confined to sandy pockets at the heads of coves. The beaches are exposed to heavy seasonal surf; few approaches are channeled; foreshore slopes average approximately 1 on 75; the beaches average 75 to 100 feet in width. Five beaches or groups of beaches in this sector are described in detail in the text (beach areas (14), (50), (62), (114), and (125)); all these are located at the heads of fairly large bays and in the vicinity of ports.

The slopes and cliffs are backed by steep hills or rugged mountains, and the beaches by alluvial plains that terminate a few miles inland at the mouths of deep, narrow valleys. Within 20 miles or less of the coast, mountains rise to heights of 4,000 to 6,000 feet.

Vegetation on the uplands consists chiefly of a mixture of grass, brush, scrub pine, and scattered pine trees. The alluvial areas are cultivated in irrigated rice and grain.

B. South coast.

The approaches to the south coast, between Sungdumal (Yōtō-matsu or Harito Kutsu) and Haenam-gak (Kainan-kaku), are obstructed by numerous off-lying islands and islets, and by rocks, reefs, and shoals. Most of the approaches to the outer islands and islets are relatively clear. Two large islands, Tsushima and Cheju-do (Saishū-tō or Quelpart Island), lie off the eastern and western extremities of the south coast, respectively; they are separated from the mainland and its off-lying islands by channels 30 to 40 miles wide.

Bottom gradients are irregular, and range from steep to flat. Along the greater part of the coasts of both the mainland and the islands, however, the gradients are steep to moderate.

Off the hilly or mountainous stretches, the bottom near shore consists of a mosaic of rock, gravel, sand, mud, and shells; off the alluvial stretches it is composed of mud or sand with patches of shells. Seaward, the bottom materials grade into mud with local areas of sand or shells.

The coast is irregular, consisting of long peninsulas alternating with deeply indented bays. Much of the coast, particularly along the bays, is fronted by drying tidal flats, ranging from narrow to broad, composed of mud or sand.

Cliffs and slopes of varying degrees of steepness, backed by hills or mountains, make up most of the coast. The cliffs and slopes generally rise directly from the water's edge, but in many places, particularly at the heads of the coves, they are fronted by narrow beaches. At varying intervals, the hilly or

mountainous parts of the coast are broken by low, level, sandy or muddy stretches which range in length from a few hundred feet to several miles. These stretches front alluvial flats or plains; where the coast is muddy, diked salt pans or earth embankments may border the shore. The largest river plains lead inland from the heads of the principal bays.

The only described beaches in the area are beach area (181), near Yosui (Reisui), and beach area (217), near Mosulp'o on Cheju-do. Most of the beaches are protected from heavy surf; approaches are generally channeled; foreshore slopes average 1 on 200 or flatter; the beaches are fronted by wide drying flats, and average 25 to 50 feet wide.

The mountains which back the coast and surround the alluvial plains are highest in the eastern part of the sector, and become progressively lower westward; they are steep and rugged throughout. The mountain slopes are cut by numerous short, steep, narrow ravines.

The coasts of Tsushima are mainly steep and cliffy, but there are numerous pocket beaches, mainly at the heads of indentations where streams have formed small alluvial flats. The coasts of Cheju-do (Saishū-tō or Quelpart Island) are more regular in outline than those of Tsushima, but are almost entirely steep and rocky; of the few beaches on Cheju-do, the majority are fringed with rocks. The larger of the islands lying close off the mainland coast have a coastal terrain similar to that of the mainland, except that extensive river plains are lacking; the smaller islands and islets consist of hills or mountains terminating in cliffs.

Vegetation on the upland areas of both the mainland and the off-lying islands and islets consists principally of a mixture of grass, brush, and scrub pine and other coniferous trees. Stands of broadleaf trees are present in places, particularly on Cheju-do. Some of the lower, gentler hill slopes are cultivated. The alluvial flats are planted chiefly to irrigated rice or grain. Deciduous orchards occur around most of the villages.

C. West coast, southern and central parts.

The western coast between Haenam-gak (Kainan-kaku) and Changan-got (Chansan Kotsu) is very irregular both in outline and in offshore gradient. The approaches are encumbered by broad shoals, detached banks, and numerous archipelagos. Channels leading through the islands and shoals are narrow, difficult, and in many places shallow. The shores, both of the mainland and the numerous islands, are generally fronted by broad mud flats which fill most of the inlets and in places extend two or three miles from the coasts. Stretches of sand flats along the outer edge of the tidal mud flats are common.

The coast of this sector generally consists of slopes and occasional stretches of cliffs, which are broken at intervals by low alluvial flats. Sandy beaches appear in places but they are usually small and fronted by mud flats. The beaches are similar in physical character to those on the south coast. Only two large described beaches lie in this sector (beach areas (243) and (288)). Cultivation along the coast consists almost entirely of irrigated rice fields and these are confined to narrow coastal strips and small valleys. These fields are generally protected by dikes, and in some places sections of the tidal mud flats have been reclaimed for cultivation. Salt pans are common along the shores of the inlets.

The terrain back of the coast is generally hilly. Low hills

predominate, but more precipitous slopes rising to elevations of 500 to 800 feet are also common, and there are some peaks of 1,000 feet or more. The lower slopes of these hills are grassy, with many patches of scrub pine growth. The higher hills usually have a cover of coniferous trees with occasional broadleaf growth.

D. West coast, northern part.

The nearshore approaches to the west coast north of Changan-got (Chansan Kotsu) generally are shallow, particularly along the northern part. They are obstructed by many long, narrow shoals and detached banks stretching in a general north-south direction. Many of the shoals and banks are marked by drying sand bars. Several islands lie off the coast, particularly in the northern part of the area.

The coast in this sector is varied. Along much of the coast, hills fall steeply to the sea, and offshore rocks are common. Elsewhere, there are long unbroken stretches of marsh and several sandy stretches, particularly in the south. The southern part of the coast is fronted by narrow tidal sand flats; in the remainder of the sector, the coast commonly is fringed by broad mud flats, some of which merge seaward into sand flats.

The coastal plains tend to be somewhat larger in this sector than farther south, and the hills on the promontories and back of the coast generally are steep and somewhat higher. The beaches are similar in physical character to those on the south coast. No beaches in this sector have been described in detail in the text.

The alluvial flats and the rugged stretches of the coast are backed by hills and mountains in which elevations of more than 1,000 feet are common. Cultivation in the valleys and on the coastal plains is largely limited to irrigated rice. Cover on the uncultivated plains and on the hill slopes is generally grass and scrub pine, with some sparse growth of other coniferous and broadleaf trees.

5. Climate and Weather

Korea, on the eastern borders of the continent of Asia, has a climate which is largely continental in character in winter, when the principal air streams flow out from high pressure over the continent of Asia toward lower pressure off the Asiatic coast, and largely maritime in character in summer, when the prevailing air streams are from the Pacific across the coasts toward lower pressure in the interior of Asia. As a result, the winters are relatively dry and cold and the summers are moist and hot. The contrasts between winter and summer are extreme, and year-round residence requires adjustment to the severely cold weather of the Asiatic winters and the "hothouse" climate of the tropic-like summers.

A. Storms.

Cyclonic disturbances seldom affect Korea in the winter months, but are quite common in the spring and early summer months. Several types affect the peninsula. Storms which sweep far to the north over Siberia have trailing cold fronts which bring unsettled weather and rain to Korea, and, occasionally in the spring, widespread dust from the deserts of Mongolia and north China. Other disturbances cross Korea directly from

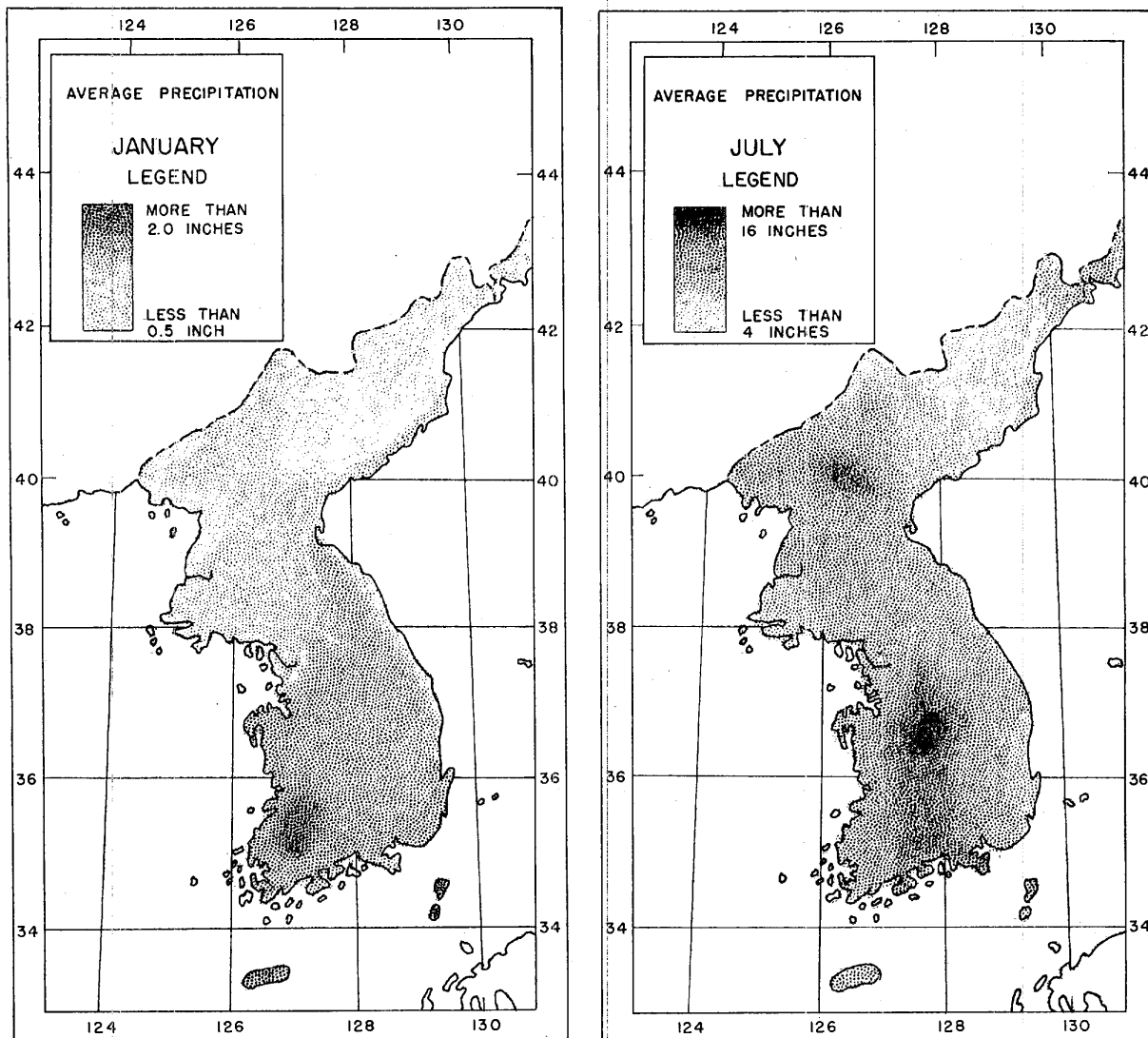


FIGURE I - 6. *Precipitation.*
Average precipitation for January and July.

Mongolia and Manchuria. Wave disturbances form on fronts quasi-stationary in the Hwang-Ho region and cross the Hwang Hai (Yellow Sea) directly to Korea, causing widespread rains. Other fronts that become quasi-stationary over the Yangtze Valley develop waves which have an adverse effect on the weather in southern Korea. At other times the polar front may become quasi-stationary across Korea in summer, attended by general rains over the peninsula, even though cyclonic disturbances do not form on the front. A northward extension of the intertropic front, very diffuse and evident only as a zone of convergence, may also lie across Korea in midsummer and may be attended by heavy rains.

Typhoons may be expected to affect Korea on the average of twice a year, their period of occurrence being limited to the period 1 June to 15 September. Typhoons are very severe storms which effectually stop operations of all types during their passage. They are attended by widespread low overcast,

torrential rains, winds speeds of 75 to 150 m.p.h. or more, and by very high "following tides" which cause immense damage along windward coasts.

B. Precipitation.

Mean precipitation in Korea varies between approximately 20 inches in the northeast along the upper reaches of the Tuman-gang and nearly 60 inches along the south coast in the vicinity of Sunch'on (FIGURE I-11). Over most of the peninsula the annual precipitation varies from slightly less than 40 inches to more than 50 inches, the lesser amounts occurring along the northwest coast in the vicinity of P'yongyang and over the smaller islands off the west coast, and the larger amounts, in the more mountainous interior. At Izu-hara on the neighboring islands of Tsushima, as much as 90 inches is normal.

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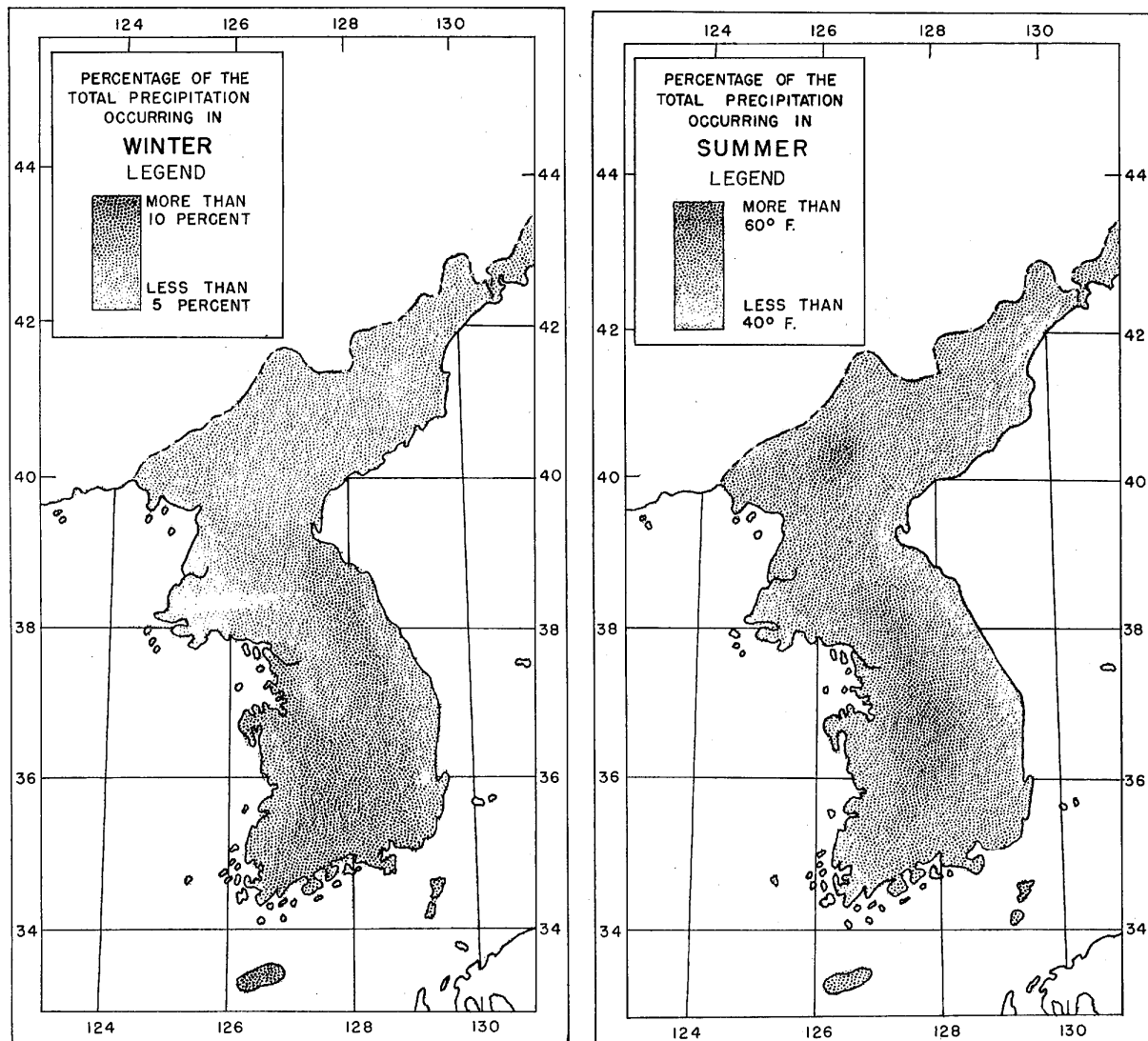


FIGURE I - 7. *Precipitation.*
Percentages of precipitation in winter and summer.

The seasonal distribution of precipitation is very striking (FIGURE I - 7). Approximately 85% of the annual amount of precipitation falls in the period April through September. The winter precipitation is very light, varying between less than an inch monthly in the interior to slightly over 2 inches monthly along the southeast coast. Winter precipitation is most frequent along the southwest coast and over the more mountainous islands. Moderately heavy precipitation occurs on Ullung-do, where snow, or occasionally rain, falls 5 of every 6 days in winter. During spring and summer the amount of precipitation in Korea increases rapidly until July, when it reaches a maximum. Total amounts for July vary from 4 or 5 inches in the drier valleys of the northeast to 12 to 14 inches in localities in the west and south near the mountains. In rainy years 18 to 25 inches are not uncommon amounts to be received at these stations.

Snow may occur anywhere in Korea in the winter months,

but the total amount is so small that depths of more than one foot are not to be expected except on Ullung-do and in interior valleys, where the snow is blown off the adjacent mountains into the valleys.

C. Temperature.

Winter temperatures are severe in northern Korea, with mean minimum temperatures consistently below zero, and extreme minima of -30° to -40° F. (FIGURE I - 8). In January, the coldest month, there is a difference of 40° F. in the average temperatures between Chunggangjin in the extreme north-central part of Korea and Mokp'o on the southwest coast. In the latter place minimum temperatures average a few degrees below freezing, with extremes between 5° and 10° F. Summer temperatures throughout Korea are consistently high, but not extreme (FIGURE I - 9). At low-level stations the average summer temperatures are between 75° and 80° F. in

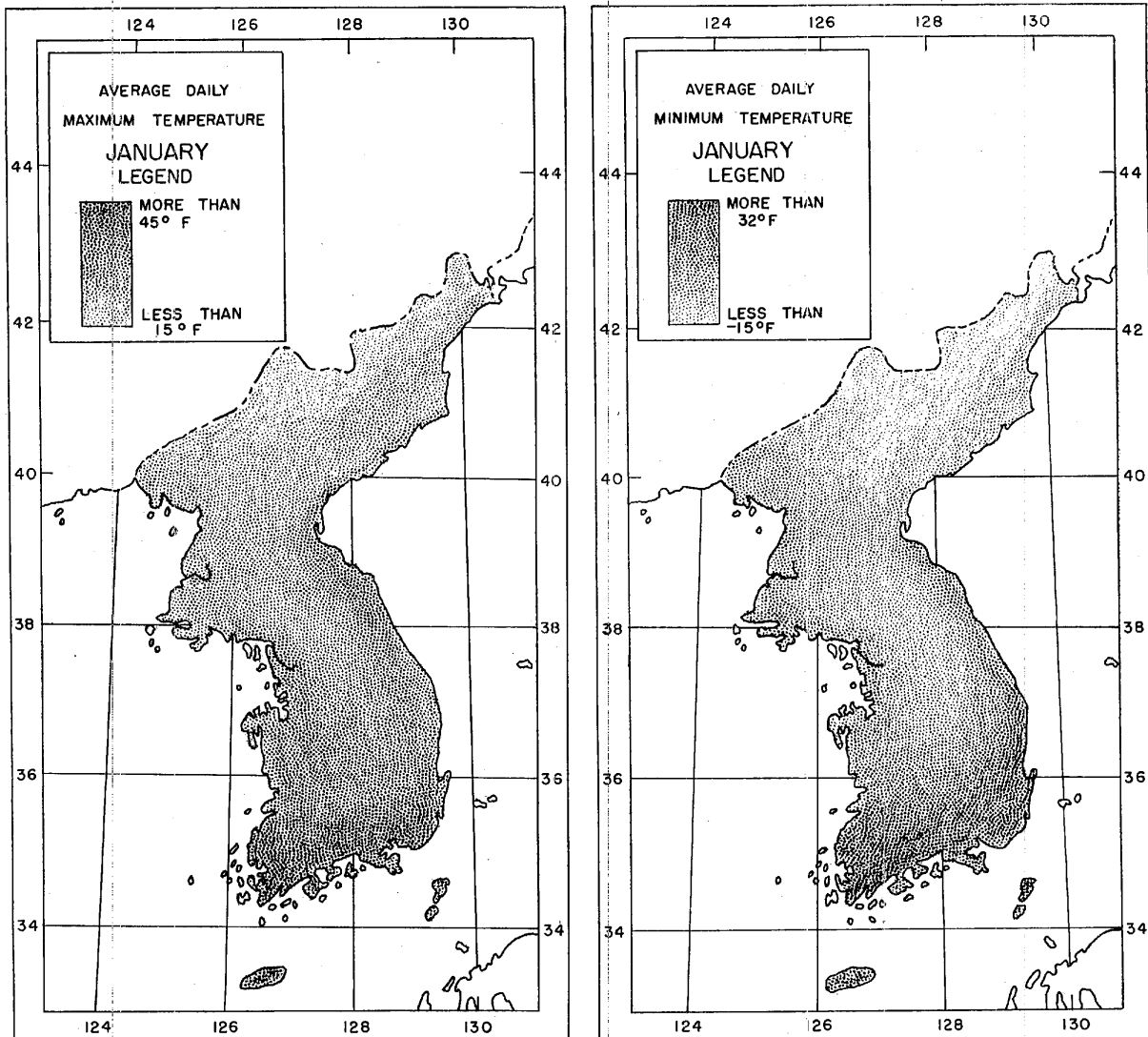


FIGURE I - 8. Temperature.
Average daily maximum and minimum temperatures for January.

the warmest month, with average maxima between 83° and 88° F. and extreme maxima near 100° F.

D. Humidity.

Relative humidities are moderate throughout the cooler months of the year but are consistently high in midsummer (FIGURE I - 10). The moderate humidities of the cool season do not impose any particular problem in relation to military operations, but the high humidities of the summer require special precautions to prevent the spoilage of foodstuffs, the corrosion of metals, the molding of leathers and other fabrics, and injury to technical instruments.

E. Surface winds.

In a country as mountainous as Korea, surface winds tend to be greatly modified by the local topography and do not reflect the gradient wind flow. In the cool season of the year the

prevailing air flow is between north and northwest, except in the northwestern portion of the country along the Amnok-kang, where the gradient flow is between north and northeast. Strong surface winds blow along the southwest coast, where the winds have had a long sweep over the waters of the Hwang Hai (Yellow Sea), and along the northeast coast, where they flow directly from the cold interior to the warmer sea surfaces of the Japan Sea. Very light winds are the rule in protected valleys of the interior. In the spring and fall months downslope (*foehn*) winds from the mountains of the interior to the coasts of the Japan Sea are quite frequent. This condition arises whenever a deepening cyclonic disturbance in the adjacent portion of the Japan Sea is associated with rising pressure over the mountains of Korea. The *foehn* winds are attended by high temperatures and very low humidities. They are particularly noticeable in the vicinity of Wonsan. In summer, both wind direction and wind speed are extremely vari-

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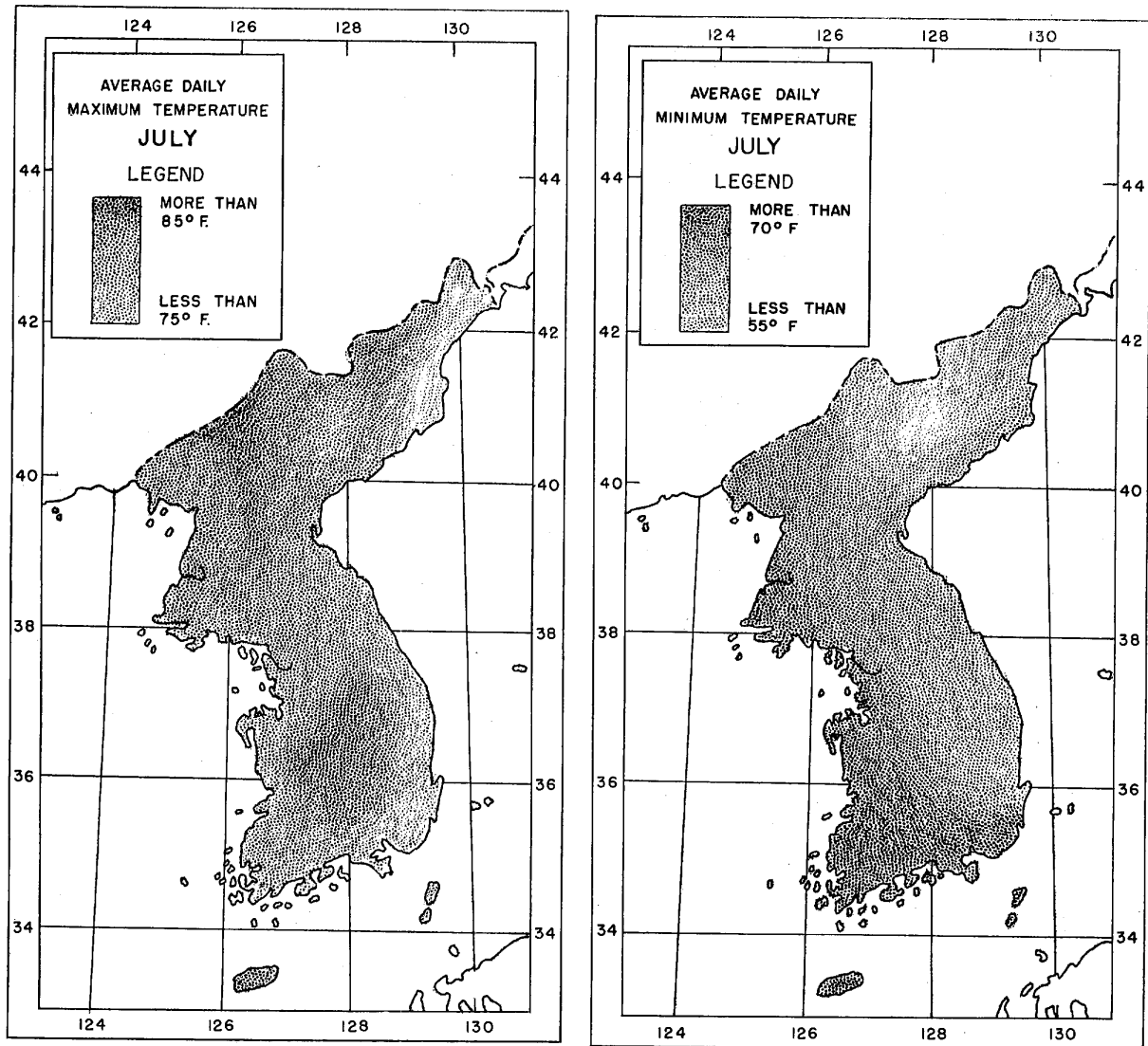


FIGURE I - 9. Temperature.
Average daily maximum and minimum temperatures for July.

able. Wind roses for a south coast and a west coast station are given in FIGURE I - 11.

F. Winds aloft.

Winds aloft in the cool season of the year are from the northwest in the lower levels, backing to west with increasing elevation. Very high wind speeds are to be expected at times because of the steep pressure gradients which occur aloft over Korea. In summer the winds aloft are variable up to 10,000 feet, with westerly winds prevailing above that level. Very high winds are not to be expected at ordinary flying levels in summer.

G. Cloudiness.

Cloudiness in the winter months varies largely with the location of the station, i.e., whether or not the prevailing winds

over the station have been modified by long trajectories over the adjacent seas. Where the trajectories of the prevailing air flow have been entirely over land, the skies are predominantly clear. This is the case in northern Korea, where the average cloudiness in the winter months is 30 to 40%. Where the trajectories of the prevailing air flow have been over the Hwang Hai (Yellow Sea) or over the Japan Sea, overcast conditions with stratocumulus clouds are common. This is the case along the southwest coast of Korea and over the larger islands, with average cloudiness over the former 55 to 65%, and over the north coasts of the large islands such as Cheju 80 to 85% (FIGURE I - 12). In summer the cloudiness is high throughout all of Korea, averaging 70 to 80% over most sections. Quelpart (Cheju-do) has less cloudiness in summer than in winter (FIGURE I - 13).

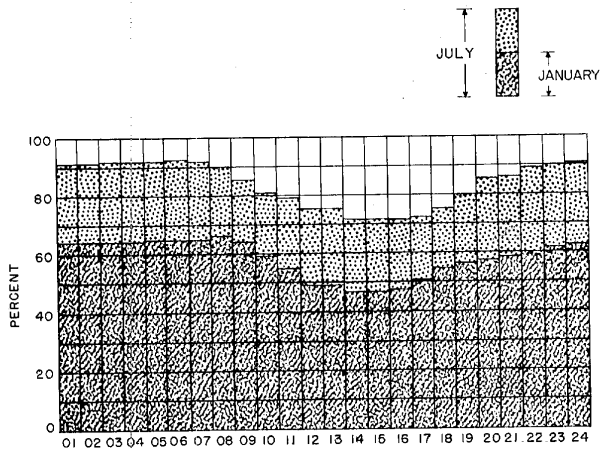


FIGURE I - 10. *Humidity.*
Average relative humidities for July and January.

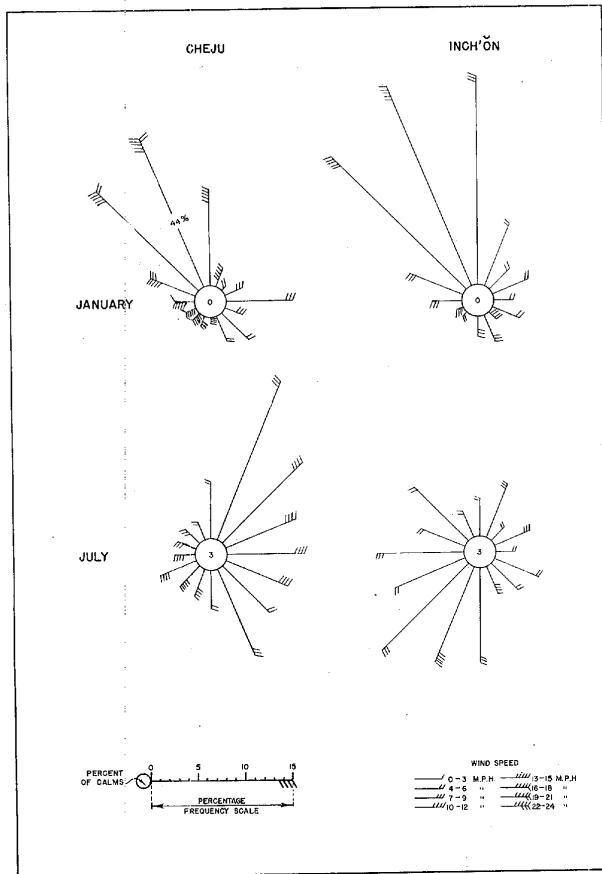


FIGURE I - 11. *Surface Winds.*
Wind roses for Inch'on, on the west coast and for Cheju, off the south coast.

H. Ceilings.

Ceilings in winter probably average between 2,500 and 4,000 feet under stratocumulus clouds, the most frequent type at that time of year. In summer they probably average between

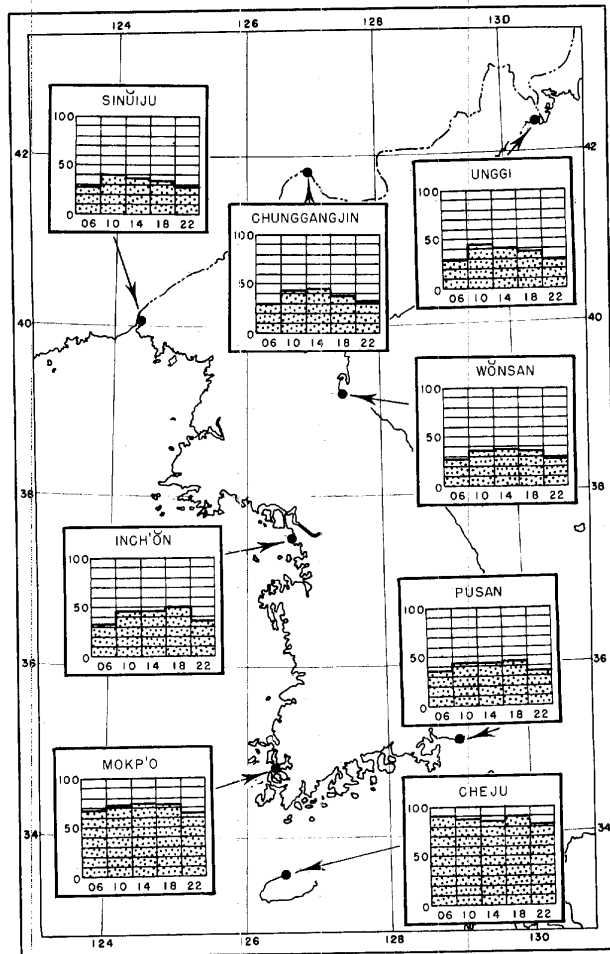


FIGURE I - 12. *Cloudiness*
Mean percentages for January at times of observations.

a few hundred feet and 2,000 or 3,000 feet under stratus clouds along the coasts and over the adjacent seas. This is the most frequent cloud along the coasts, thus accounting for the fact that the average cloudiness is somewhat higher along the coasts than in the interior. In the interior the most frequent low cloud in summer is the cumulonimbus. Ceilings under this cloud type are usually adequate for contact flight, but the ceilings may be very low over the mountains and in the mountain passes.

I. Turbulence.

Turbulence is a common phenomenon in the lower levels of the atmosphere in the winter months, when cool air streams from the interior of Asia flow over the warmer land surfaces of Korea and the warmer waters of the adjacent seas. In summer turbulence extends to higher levels than in winter, and is primarily of the convective type. Local thunderstorms occur in the mountain areas and appear to be most frequent in the north, Chunggangjin reporting an average of 21 yearly. Turbulence is associated also with the passage of fronts across Korea, most frequently in the spring and summer months.

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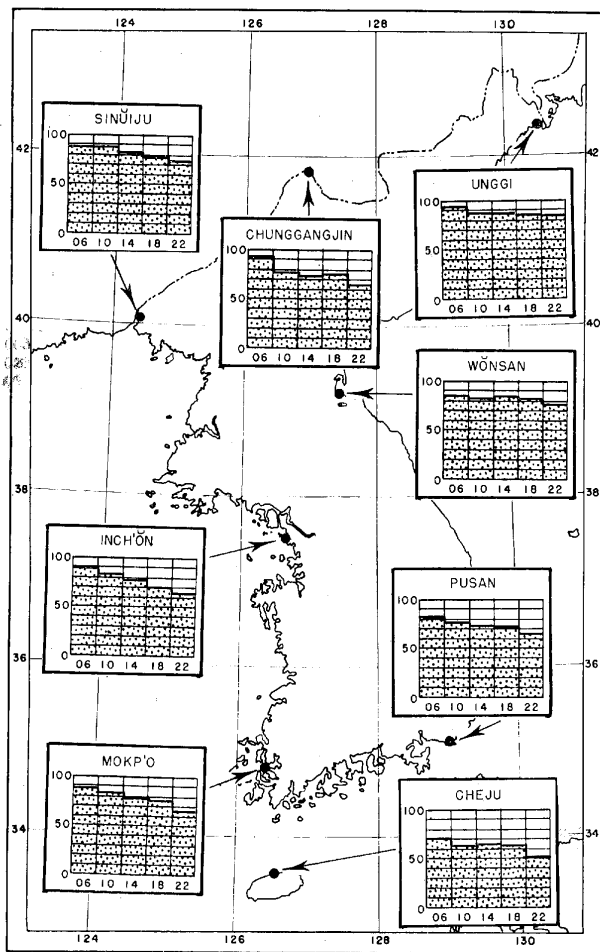


FIGURE I - 13. Cloudiness.
Mean percentages for July at times of observations.

J. Icing.

Icing aloft is most frequently associated with cold front passages and may occur between 4,000 and 12,000 feet in the transitional months, but over 12,000 feet in the summer months. Icing conditions in frontal zones are more severe where the frontal zones pass over mountain ranges. Icing may also take place in the stratocumulus clouds of the winter season, particularly where such clouds are forced to rise over mountain slopes. Under these conditions, icing could occur between 2,000 and 8,000 feet.

K. Visibility.

Visibility may be reduced by fog, dust, precipitation, haze or smoke and by falling rain or snow; the incidence of the latter has already been mentioned. Two types of fog are important in Korea. The first is the sea fog, which is most frequent from late in March through July, with maximum frequency in June. It forms when warm moist air of subtropical origin moves slowly northward across cooler waters. The fog is most commonly observed along the northeast and west coasts of Korea, averaging 10 days monthly at exposed points at the peak of

the season. In the cooler season of the year, and also in late summer, radiation fogs may form in the sheltered valleys in the interior. These fogs are shallow and usually burn off by 1100.

Dust is occasionally carried aloft over Korea from the deserts of Mongolia and north China. The occurrence of dust is most likely in the spring of the year, when active fronts move across Mongolia, and before the rainy season sets in. Dust has been carried well into southern Japan under favorable conditions.

Damp haze is characteristic of maritime tropical air masses and may be expected quite generally over Korea in midsummer. It limits visibility to approximately 6 miles; the range of vision in maritime tropical air is appreciably lower than in polar continental air.

6. Ports

A. Introduction and summary.

The major ports of Korea are industrial centers and gateways for supplies and raw materials between Japan and Manchuria. Korea has no world trade ports; facilities have been developed either to serve adjacent industries or to transship cargo at railroad terminals. Of the 10 principal ports, Pusan, on the southeast coast, is the most important. Most of the 29 secondary ports are fishing centers only.

In addition to the principal and secondary ports, there are at least 10 other landings around the coast of Korea and at least 11 landings on off-lying islands, divided as follows: 1 on Ullung-do; 4 on Tsushima; and 6 on Cheju-do. Significant details on these landings are listed in Chapter VI, Port Facilities, TABLE VI - 21.

Around the coast of Korea and off-lying islands there are at least 128 anchorages, some of which are adjacent to ports and landings. Chapter VI, Port Facilities, TABLE VI - 22, lists the significant details on all the anchorages. FIGURE I - 22, which appears on an apron at the end of this chapter, locates all the anchorages, ports, and landings.

A sea distance of only 120 miles separates the southeastern tip of the Korean peninsula from Japan proper; China is separated from Korea by the narrow Yellow Sea; and the shortest distance between Vladivostok and the Korean boundary is only about 80 miles.

All principal ports have rail connections. Most of the ports on the northeastern coast of Korea are linked to each other by an east coast railroad line which is tied into the South Manchurian Railroad line near Ch'ongjin. Another branch of the South Manchurian line leads inland from the ports of Unggi and Najin. It is possible that the Korean east coast railroad has been extended southward connecting with additional ports.

The Pusan - Mukden railroad line enters Korea from Manchuria at the secondary river port of Sinuiju - An-tung and continues diagonally across Korea to the terminal port of Pusan on the southeast coast. Pusan, the port closest to Japan, has terminal facilities for the direct handling of freight and passengers from a regular ferry route which links Japan proper with the Pusan - Mukden railroad line. The other terminus of the ferry route is Shimonoseki, a principal port and transportation center on the island of Kyūshū in Japan proper (JANIS 84, Southwest Japan). Branches from the Pusan - Mukden line serve most of

the ports on the south and west coast of Korea. Yosu, on one of these branches, is the terminus of a 9- to 10-hour sea route connecting with Hakata in Japan proper. Roads and railroads linking and serving to clear the ports of Korea are shown on FIGURE I-23, the transportation map.

Ice does not greatly affect navigation at the coastal ports of Korea. Along the northeast coast of Korea, at the principal ports of Unggi and Najin, and the secondary port of Sosura, ice may interfere with lightering and the use of small craft, and it is reported that an ice-breaker is used at Unggi. The 4 river ports in the northwestern section of Korea—the principal port of Chinnamp'o and the secondary port of Kyomip'o on the Taedong-gang, and the secondary ports of Yongamp'o and Sinuiju - An-tung on the Yalu River—are closed by ice during part of the winter. Drift ice may block the entrance to Chinnamp'o for 3 weeks or more in January and February; at Kyomip'o the river is frozen from the beginning of January to March. Both Yongamp'o and Sinuiju - An-tung are closed by ice from about the first of November to the first of May. At other coastal ports there is no interference from ice.

For the purposes of this study, the division of ports into categories of principal and secondary is entirely relative and arbitrary. Ports capable of handling more than 1,000 long tons of cargo per day alongside landing facilities have been considered principal ports; those capable of handling less than 1,000 long tons per day have been described as secondary ports. In general, the principal ports have anchorage, landing, cargo-handling, and adequate clearance and storage facilities to accommodate ocean-going vessels; secondary ports have facilities for handling only coasters or even smaller craft—generally fishing craft.

In addition to principal and secondary ports, there are some places where shipping is carried on, but because of limited facilities or lack of data, these places have been classified as landings.

The estimated daily port unloading capacity, as used in this study,* is computed by multiplying the number of vessels that can be continuously discharged alongside and in the stream by the total number of tons that can be discharged per ship per day.

In estimating alongside capacity, a Liberty ship (500-foot berth in depths of over 24 feet) and a coaster (300-foot to 350-foot berth in depths of 20 feet to 24 feet) were assumed as standard vessels. The discharge rate of a Liberty was considered to be 600 long tons per day, and the discharge rate of a coaster was considered to be 400 long tons per day.

In estimating the discharge capacity of vessels riding at anchor in the stream, the lesser of the following computations was used:

First—the total length of piers, quays, and bulkheads available for use by lighters in depths of over 6 feet was multiplied by 1½ long tons per foot to obtain the capacity of shore facilities for lightering per day;

Second—the number of first-class anchorage berths available at a port was multiplied by 500 long tons to obtain the anchorage discharge capacity per day.

*Note: The method of estimating the daily unloading capacity of ports covered in this study differs from the method used in previous JANIS studies. In previous studies, unloading capacity estimates were based only on the amount of general cargo that could be handled alongside deep-draft berthing facilities, assuming an 8-hour day.

TABLE I-1 gives the estimated unloading capacities of the more important Korean ports.

TABLE I-1
ESTIMATED UNLOADING CAPACITIES OF KOREAN PORTS
(Long tons per day)

A. Principal Ports			
PORT	ALONGSIDE	IN THE STREAM	TOTAL
Unggi	1,500	6,500	8,000
Najin	10,100	15,000	25,100
Ch'ongjin	4,400	15,000	19,400
Songjin	1,800	5,000	6,800
Hungnam	8,000	7,500	15,500
Wonsan	1,600	10,000	11,600
Pusan	14,800	7,000	21,800
Kunsan	1,200		1,200
Inch'on	3,000	12,500	15,500
Chinnamp'o	1,600	5,000	6,600
B. Secondary Ports			
P'ohang-dong		2,500	2,500
Kamp'o-ri		1,000	1,000
Ulsan-man		1,000	1,000
Masan		7,500	7,500
T'ong-yong		5,000	5,000
Yosu	800	2,500	3,300
Mokp'o	800	2,500	3,300
Kyomip'o		2,000	2,000
Dasado*	1,200		1,200

*Although the estimated unloading capacity alongside landing facilities for Dasado is more than 1,000 long tons per day, it was described as a secondary port because the capacity estimate is based on facilities "reportedly" completed.

The principal ports of Unggi and Najin, 10 miles apart on the northeast coast of Korea, are Japanese military ports and are used for the movement of troops and supplies to Manchuria. Ch'ongjin, about 35 miles south of Najin, also shares in the traffic between Japan and Manchuria, but is in addition one of the leading iron and steel centers in Korea and the major outlet for the Musan iron mines, the largest in Korea. Songjin, also on the northeast coast, is a major fishing center now being developed as an industrial port and has a steel plant and a probable magnesium plant.

Hungnam and Wonsan are about 40 miles apart in the head of the large bight which indents the east coast of Korea. Hungnam is at the north end of the bight; Wonsan is at the south end. Both are primarily industrial ports. Hungnam was developed to serve 4 large plants in the chemical industry, and Wonsan is the center of the Korean petroleum refining industry. Two cross-peninsular rail- and road-routes lead inland from near Wonsan. Pusan, the leading Korean port, has the largest ship-building plant in Korea, a diesel engine plant, an iron and steel products fabricating plant, munitions factories, and an oil refinery.

Although the east coast ports have small tidal ranges, averaging about 1 foot, the ports on the west coast have very large ranges of up to 30 feet, which seriously affect navigation. Kunsan and Changhang-ni are on the Kum-gang estuary in southwestern Korea and share a common harbor. Kunsan is mainly an export center for wheat and other agricultural products; Changhang-ni has been developed to serve a non-ferrous metals refinery. Inch'on, on the Yom-ha estuary near the middle of the west coast, is the port for Kyongsong, the Korean capital, about 25 miles inland, and also serves rapidly expanding industries in its own vicinity. Chinnamp'o is in northwestern Korea on the Taedong-gang estuary, about 30 miles from the sea. It is the

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principal port for the P'yongyang industrial and mining region and the site of a naval coal depot with specialized coal-loading equipment.

Of the 29 secondary ports, only the following have been developed beyond fishing bases and refuge harbors—Ch'aho, Masan, T'ongyong, Yosu, Mokp'o, Yongdangp'o, Kyomip'o, Dasado, Yongamp'o, and Sinuiju—An-tung. With the exception of T'ongyong, all these ports have rail connections. Most of them are on the south and west coasts; the greatest concentration of fishing bases is on the southeast coast.

Chinhae (Chinkai), on the southeastern coast near the secondary port of Masan, is the only significant naval base in Korea. Some naval use has been made of Takeshiki on the off-lying island of Tsushima. Both of these places are described in Topic 13, Naval Facilities.

In the description of most of the ports, reference is made by a plan number to plans which show, on an AMS 1:250,000 base, the location and extent of landing beaches near the coastal ports. These plans are in the JANIS 75 Plans Pouch. The more important landing beaches are described in Chapter IV.

Anchorage berth classifications used in this chapter are defined as follows:

First class—a 500-yard diameter circle with a minimum depth of 35 feet.

Second class—a 400-yard diameter circle with a minimum depth of 25 feet.

Third class—a 300-yard diameter circle with a minimum depth of 15 feet.

B. Principal ports.

(1) Unggi (Yüki) (42° 20' N, 130° 24' E).

Unggi (Yüki), a town under Japanese military command, is on the northeast coast of Korea near the meeting of the Russian, Manchurian, and Korean borders (PLANS 4 and 47). Together with Najin, 10 miles southwestward, and Ch'ongjin, the port of Unggi shares the traffic between Japan and central Manchuria. The only deep-draft landing facility, a 1,500-foot concrete quay with depths of 24 feet alongside, can berth four 4,500-ton vessels. The estimated total daily unloading capacity for the port is 8,000 long tons, with 1,500 long tons handled at the concrete quay and the rest worked in the stream. Adequate facilities are available for handling lighters in a small craft basin.

The harbor is at the head of a small indentation in the northwest corner of Zosan-man, a larger bay. The bay is well protected from all directions but the southwest. Since it is open to the southwest, it is subject to heavy squalls in summer. The harbor provides good anchorage for a limited number of vessels; additional anchorage is available in adjacent areas. The small craft basin freezes solid in winter, and shore-fast and skim ice are frequently in the harbor, but it is reported that a local ice-breaker keeps the harbor clear.

(2) Najin (Rashin) (42° 13' N, 130° 18' E).

Najin (Rashin), on the northeast coast of Korea between Unggi (Yüki) and Ch'ongjin (Seishin), is about 100 miles southwestward of Vladivostok (PLANS 4 and 37). A fishing village prior to 1933 when the Japanese started a major port development program, Najin is now a military port for the movement of troops and supplies to central Manchuria. The

Najin—Hsinking (Manchuria) Rail Line, operated by the Japanese Army since 1938, has direct connection with the port facilities and is regarded as the main artery of Japanese military and economic supply between the home islands and Manchuria.

After considering Unggi, Najin, and Ch'ongjin for the site of a key military port, the Japanese Government started harbor construction at Najin in April 1933. The original construction program, divided into 3 parts, called for completion of sufficient facilities to handle 3 million tons of cargo annually by 1938; 6 million tons by 1943; and a total of 9 million tons by 1948. Some installations were completed by 1936 and work has continued since that date, but it is doubtful that the full program has been maintained. The harbor handled almost 900,000 tons of cargo in 1937—the fifth largest tonnage in Korea for that year.

Available reports vary greatly as to how much of the original landing facility construction program has been completed, but 1943 Japanese charts, partially supported by aerial coverage of poor quality, indicate the existence of 3 piers, 1 large quay, and 4 wharves. These facilities can berth an estimated 47 vessels, including nine 500-foot ships and four 450-foot ships drawing over 30 feet. The 3 main piers have warehouses; railroads service all the important landing facilities; but little information is available on mechanical handling facilities.

The estimated daily unloading capacity is 25,100 long tons, with 10,100 tons discharged alongside deep-draft landing facilities and 15,000 long tons worked in the stream by 30 Liberty ships. The total capacity is greater than that of any other Korean port.

The deep natural harbor at the head of Najin-man is relatively well protected. Extensive anchorage including about 76 first-class berths is available in the harbor and adjacent bays. The harbor does not become ice-bound, but floating ice and some freezing may be encountered in December and January.

Both the town and harbor are under military control. The Rashin Naval Station, with a small naval base, is headquarters for the naval district which embraces most of the east coast.

(3) Ch'ongjin (Seishin) (41° 46' N, 129° 49' E).

Ch'ongjin (Seishin) is in the northeastern corner of Kyongsong-man, a large open bay which indents the northeastern coast of Korea between Gyoro-dan and Komalasan-dan (PLAN 5). It handles some of the traffic between Japan and Manchuria, and is one of the leading iron and steel centers in Korea. In addition, it has a large fishery-products and bean oil industry; the former is now reported as being principally devoted to production of glycerine. The port is the major outlet for the Musan iron mines, the largest in Korea, which are 43 miles northwest of Ch'ongjin.

The port has 3 harbors: Commercial Harbor, the only one that can accommodate deep-draft vessels, fronts the city proper; and 2 industrial harbors have been developed southwestward of the city to accommodate lighters and shallow-draft vessels serving nearby industrial developments. Quays and a mole in the commercial harbor can berth 10 vessels—8 drawing 26 feet or more, one drawing 23 feet, and one drawing 16 feet. One industrial harbor has 9,500 feet of quayage with 11½-foot depths alongside; the second industrial harbor, still under construction, may eventually handle larger ships. It already has 6,500 feet of quayage in operation. Adequate rail and road clearance is available.

Breakwaters protect the 3 harbors; Commercial Harbor has depths from 10 to 55 feet; depths in one industrial harbor are 7 to 16 feet; and depths in the second industrial harbor are not known, but are believed to be shallow. The harbor area in general is protected from the north and northeast by hills on the mainland and adjacent peninsula, but the harbor area is open to the southward and subject to occasional heavy swells in summer. There is anchorage in the northeast portion of the harbor area; depths outside the breakwaters range from 5½ to 19 fathoms, mud and sand bottom. The harbor area probably can provide 35 first-, 7 second-, and 8 third-class anchorage berths; four 8,000-ton ships can be accommodated at anchorage berths inside Commercial Harbor.

The estimated unloading capacity for all 3 harbors is 19,400 long tons per day: 4,400 long tons discharged alongside landing facilities in Commercial Harbor and the rest handled offshore by 30 Liberty ships.

Nearby rivers freeze in winter, but ice is rarely a navigational problem in the harbor area.

(4) *Songjin* (40° 40' N, 129° 13' E).

Songjin (Jōshin), a major fishing center now being developed as an industrial port, is on the northeast coast of Korea, 118 miles southwest of Najin (PLAN 6). The port has a magnesium plant and a steel plant, and exports lumber, crude magnesite ore, and magnesite.

The bay harbor is easily accessible and clear of hazards, but has excessive depths and is exposed to the southward. The harbor is not obstructed by ice. A breakwater gives partial protection to North Harbor, which includes a 1,400-foot new Main Wharf with 30 to 45 feet of water alongside, a lumber quay, and 2 basins—one for small craft and the other for timber storage. Northward of North Harbor, near the magnesium plant, is a lighter basin, apparently used in connection with the plant. Southward of North Harbor is an artificially protected fishing harbor with quayed inner shores for mooring small vessels.

North Harbor has 4 first-, 5 second-, and 3 third-class anchorage berths, and unlimited temporary anchorage is available in the exposed bay. Nearby rivers freeze in winter, but the harbor is neither ice-bound nor obstructed by ice. The new Main Wharf can berth three 450-foot ships and is estimated to have a daily unloading capacity of 1,800 long tons. The remainder of the landing facilities at the port are for lighters and small craft. It is estimated that 5,000 long tons can be discharged from approximately 10 Liberty ships in the stream, giving the port an estimated 6,800 long ton daily unloading capacity.

(5) *Hungnam* (Kōnan) (39° 50' N, 127° 37' E).

Hungnam (Kōnan) is on the east coast of Korea about 40 miles north of Wonsan (Genzan) (PLANS 29 and 36). It is one of the world's largest producers of ammonium sulphates, and in the Japanese Empire it is the largest producer of nitric acid, glycerine, sulphuric acid, and magnesium. The port has been developed in the last 12 years to import the raw materials and export the products of 4 large industrial plants on or near the waterfront. The largest of the plants belongs to the Chosen Nitrogen Fertilizer Co., and covers an area of about 2,000 by 700 square yards immediately behind the main landing facilities; it produces fertilizers and light metals. The other plants are an explosive factory, about 1½ miles southwest of the main land-

ing facilities, and a chemical plant and a new nitrogen plant, both about 2 miles inland from the landing facilities.

Hungnam has only 4 deep-draft landing facilities, but these can accommodate 11 vessels from 300 to 500 feet long, drawing 20 to 30 feet, and one 225-foot vessel drawing 16 feet. Dock No. 1, which provides the most berthage, is equipped for intensive cargo-handling; it has a large rail-track footage, four 10-ton traveling bridge cranes and one 40-ton crane. The other deep-draft landing facilities have no fixed cranes but are probably served by 3-ton cranes which travel on narrow-gauge tracks. Around the shores of Sohojin-man are 5 landing facilities with depths less than 10 feet.

The most serious limitation of the port is the small size of the harbor, which provides only 1 second- and 7 third-class anchorage berths. Vessels waiting to berth at the landing facilities often have to anchor in the roadstead which is exposed to the south, southeast, and southwest.

The shortage of protected anchorage makes Hungnam one of the few ports in Korea at which more cargo can be handled alongside landing facilities than in the stream. It is estimated that 8,000 long tons can be discharged per day alongside the landing facilities, and 7,500 long tons into lighters in the stream. In winter, only a thin surface of ice freezes in the harbor; it does not interfere with navigation.

(6) *Wonsan* (Genzan) (39° 10' N, 127° 26' E).

Wonsan (Genzan) is on the east coast of Korea, at the southwestern corner of the large bay, Tongjōson-man, which narrows the Korean peninsula to a "neck" about 100 nautical miles across (PLANS 9 and 45). It has one of the best natural harbors in Korea, providing unlimited sheltered anchorage, and is a regular port of call for ships from western Japan and northern Korea. The east coast terminus of the easiest rail- and road-route across the Korean peninsula is at Wonsan, and another cross-peninsula railroad joins the coastal line about 20 miles north of Wonsan.

Wonsan is the center of petroleum refining in Korea; the Chōsen Oil Refinery on the south side of the harbor is one of the largest in the Japanese Empire; the Rising Sun Petroleum Co. has installations about 5 miles northwest of Wonsan at Mun'p'yong-ni. Other industries are believed to be small. A naval air station is close east of the city, and the Japanese Navy uses the coal and oil stocks at Wonsan; there may be further naval development (Chapter XIII).

Three landing facilities can berth sea-going general-cargo vessels; they can accommodate 2 vessels in depths of 24 to 25 feet and 5 vessels in depths of 12 to 16 feet. Unlimited protected anchorage over good holding-ground is available off Wonsan. Within the harbor administrative limit are 4 first-, 16 second-, and 30 third-class anchorage berths. The estimated total unloading capacity is 11,600 long tons per day, of which 1,600 tons are worked alongside at landing facilities, and 10,000 tons are worked into lighters in the stream.

Warehouses near the waterfront at Wonsan have a total area of 188,250 square feet. Oil storage tanks at and near Wonsan probably have a total capacity of about a million barrels.

Thin ice forms in the harbor area about 2 months a year, but does not interfere with navigation.

(7) *Pusan* (Fusan) (35° 06' N, 129° 02' E).

Pusan, on the southeast coast, is the third largest city and leading port of Korea (PLANS 15 and 39). Only 120 miles

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from Japan, Pusan is the transshipment point for military supplies and troops to the continent, and rice, cotton, steel, and coal to Japan. Prisoner of war reports indicate that it is a regular assembly point for many Japanese convoys. The port also serves as a connecting link between Japan and China south of Manchuria; the double-track Pusan-Kyongsong (Keijō) - Mukden railroad, part of an all-rail route to China, terminates at the waterfront, and 1 pier is used for the direct transfer of cargo and passengers from a ferry service that has direct connections with a similar landing facility at Shimonoseki in Japan proper. Originally the ferry service, which takes 8 hours, operated twice daily from each end, but may now be limited to 1 trip each way per day.

Although primarily devoted to commerce, Pusan has some industries, including the Chōsen Heavy Industry Co., largest shipbuilding company in Korea, and the following: a diesel engine plant reported working for the Japanese Navy, an important iron and steel products fabricating plant, a bean and cotton seed oil refinery reported to be making explosives, a gunpowder plant, a petroleum refinery, the second largest hemp plant in the Japanese empire, a fish products processing plant, a tin can plant, an aircraft assembly plant, 11 electric light bulb factories, 4 rubber companies, and some other miscellaneous factories.

The well-protected harbor area is divided into North and South Harbors, both with additional artificial breakwater protection. Recent extensive improvements of the harbor area include dredging, reclamation, and construction of a seawall and a new pier. The harbor area can provide about 14 first-, 20 second-, and 29 third-class anchorage berths.

The primary landing facilities are in North Harbor, which has all the berths for ships drawing 20 feet or more. In all, the primary facilities at Pusan can provide 34 vessel berths alongside, 9 of which handle vessels above 3,000 tons. A thirty-fifth vessel berth is provided by mooring buoys near the 2 main piers. An additional 5 berths for vessels drawing 29 feet will become available with the completion of the fourth major pier.

In addition to the primary landing facilities available at 3 large piers, 5 large quays, and 6 wharves, there are 2 specialized oil handling facilities: an oil pier and an oil basin, and a number of facilities of considerable size for handling small vessels. The port has at least 124 warehouses with a total capacity conservatively estimated at over 2 million square feet. Mechanical handling facilities are somewhat limited.

Daily unloading capacity is estimated at 21,800 long tons: 14,800 tons discharged alongside and 7,000 long tons worked in the stream by 14 Liberty ships. Completion of the new pier would raise the unloading capacity alongside to an estimated 11,500 long tons per day. Railroad clearance is available to all the primary landing facilities in North Harbor.

(8) *Kunsan (Gunzan) - Changhang-ni (Chōkō-ri)* (35° 59' N, 126° 42').

Kunsan (Gunzan) and Changhang-ni (Chōkō-ri) are in southwest Korea on the Kum-gang estuary, about 12 miles from the sea (PLAN 25). Kunsan is on the south bank of the estuary and Changhang-ni on the north bank.

Kunsan is one of the leading export centers for the agricultural products of southwest Korea; in 1935, 9,920,000 bushels of wheat were exported. Principal imports were coal, iron, iron products, salt and tobacco. Recently factories making diesel

motor parts, mining machinery, small steel ships, and ammunition have been established in and near Kunsan.

Changhang-ni has been developed within the past 10 years, mainly to handle the requirements of the Chōsen Refining Co., which produces copper and other non-ferrous metals. The estimated output of copper in 1943 was 11,000 tons, a large proportion of which was probably exported.

Vessels drawing more than 8 feet can enter the Kunsan - Changhang-ni harbor only at high tide; least entrance depths at neap high water are about 20 feet. Small islands, drying rocks, shoals, and mud flats lie on both sides of the entrance channel. About 11 third-class anchorage-berths are available in the harbor; 8 of the berths are near Kunsan and 3 are near Changhang-ni. Large ships anchor and unload at the entrance to the estuary. At Kunsan there are about 750 feet of wharfage in 18 to 22 feet of water. At Changhang-ni 1 pier has a 50-foot face in about 18 feet of water. The estimated unloading capacity is 1,200 long tons per day alongside the Kunsan facilities. Only a small amount of cargo can be unloaded in the stream.

A railroad and primary highway can clear cargo southward and eastward from Kunsan. A railroad and an improved road can clear cargo northeastward from Changhang-ni.

(9) *Inch'on (Jinsen)* (37° 28' N, 126° 37' E).

Inch'on (Jinsen) is near the middle of the west coast of Korea, on the estuary of the Yom-ha (En-ka) (river), a tributary of the Han-gang (river) (PLAN 28). It has a well-protected natural harbor and is ice-free all the year. There is a 30-foot tidal range.

Inch'on is the port of the Korean capital, Kyongsong, about 25 miles inland, with which it has good rail and road connections; it also serves the rapidly expanding industries in its own vicinity. It is the fourth largest Korean city, and its industries produce railroad rolling-stock and equipment, machinery, and steel. Ordnance and ammunition are probably also produced.

A tidal basin with lock-gates provides about 4,000 feet of wharfage in depths of over 27 feet, and is the only landing facility for deep-draught vessels; it can accommodate five 450-foot vessels drawing 27 feet. The entrance lock is 430 feet long and 60 feet wide. Almost all the small-craft facilities and most of the inner harbor dry at low water.

Unlimited anchorage is available in the channel of the Yom-ha estuary, a section of which forms the outer harbor. Within the outer harbor, which is about 2 miles from the tidal basin, are about 16 first-, 6 second-, and 7 third-class anchorage berths. Farther downstream (southward) the mile-wide channel provides excellent anchorage in depths of 5½ to 10 fathoms for a distance of about 5 miles.

The estimated unloading capacity for general cargo is 15,500 long tons per day, of which 3,000 tons are worked at vessel-berths in the tidal basin, and 12,500 tons discharged at anchor into lighters.

(10) *Chinnamp'o* (38° 43' N, 125° 25' E).

Chinnamp'o is in northwestern Korea on the Taedong-gang estuary about 30 miles from the sea (PLANS 31 and 44). It is the principal port for the P'yongyang industrial and mining region, and is the site of a naval coal depot. The coal depot has specialized coal-loading equipment and maintains a normal coal stock of 105,000 metric tons (Chapter XIII). Two non-ferrous metals factories are at Chinnamp'o: the Chōsen Riken

Metals Co. plant, which is estimated to have produced 5,000 tons of aluminum and 1,000 tons of magnesium in 1944, and the Japan Mining Co. plant, which produces lead, copper, and low grade zinc. Principal exports are rice, soy beans, iron, anthracite coal, and paper; principal imports are iron, bituminous coal, hardware, fertilizers, oils, chemicals, and textiles.

Vessels of any draft can reach the harbor, which provides about 40 first-class anchorage berths; the holding ground in some parts of the harbor is not good. Drift ice may block the entrance to the harbor for 3 weeks or more in the period from about the middle of January to the middle of February, and it may make anchoring difficult, if not impossible, for a somewhat longer period.

Four 3,000-ton vessels drawing 20 feet can be berthed at the general wharves in the harbor basin, and two 6,000-ton colliers can be berthed at the coal depot.

The estimated unloading capacity is 6,600 long tons of general cargo per day, of which 1,600 tons can be worked at the wharves in the harbor basin, and 5,000 tons worked at anchor into lighters.

Vessels drawing not more than 30 feet can reach Kyomip'o, a secondary port 16 miles farther upstream.

C. Secondary ports.

(1) *Sosura (Seisura)* (42° 16' N, 130° 36' E).

Sosura is near the northern end of Korea's east coast, about 4 miles from the Tuman-gang and the Russian border (PLAN 4). It is in the southeast corner of Sosura-hang (Seisura-ko), the easternmost bight in Chosan-man (Zozan-wan), a large and much-indented bay. Sosura is a small fishing village with facilities for landing and repairing small craft. Larger vessels may find anchorage outside breakwaters in Sosura-hang which provides about 4 first-, 3 second-, and 4 third-class anchorage berths. The bay is protected from winds between north and southeast, but is exposed to the south and southwest winds of summer. Drift ice is common from late December until late March, and shore-fast ice frequently extends 400 to 600 yards offshore during this period. The ice does not prevent ocean-going vessels from using the bay, but interferes with lightering operations.

(2) *Odaejin-hang* (41° 23' N, 129° 47' E).

Odaejin-hang (Gyotashin-ko) is a small bay on the east coast of Korea, about 25 miles south of Ch'ongjin (PLAN 5). It is a fishing base and small commercial port. About 8 third-class anchorage berths are available, but none of the landing facilities is in depths greater than 6 feet.

(3) *Yongom-ni (Yonam-ni)* (40° 23' N, 128° 55' E).

Yongom-ni (Yonam-ni, Ryugan-ri) is on the east coast of Korea, about 18 miles northeast of Ch'aho and about 2½ miles south of the inland town of Tanch'on (PLAN 7). It has an artificial harbor, part of which is in operation and part still under construction. The port is probably intended to be used in connection with an unidentified industry about ¾ mile inland. Information on the port is based entirely on aerial photographs; no information is available in charts and pilots. No depths or details on landing facilities (if any) are available, but apparently the port's facilities are to be in 2 basins, only one of which is completed. There is no protected anchorage outside the relatively small water areas within breakwaters.

(4) *Ch'abo (Shako)* (40° 12' N, 128° 38' E).

Ch'aho (Shako), an iron ore loading point, is on the northeast coast of Korea, about 164 miles north of Wonsan and 166 miles south of Ch'ongjin by rail (PLAN 7). It is approximately 400 miles from Yawata, Japan, the terminal point for Ch'aho iron ore. The mines, about 7 miles inland, are connected by rail directly to the modern ore-loading system on the port's only significant pier. The deep harbor, protected from all but southerly winds, can provide about 1 first-, 1 second-, and 3 third-class anchorage berths. Depth alongside the face of the ore pier is 27 feet, but construction of the pier does not permit unloading. It is estimated that the pier can load about 225 tons of ore per hour with a force of 12 laborers loading ore-buckets from a storage bin.

(5) *Sinch'ang* (40° 08' N, 128° 28' E).

Sinch'ang (Shinsho) is a small fishing port on the east coast of Korea at the mouth of a river called the Namdae-ch'on (PLAN 7). It is about 11 miles southwest of Ch'aho. Harbor works are in process, including reclamation and enlargement of the port area. About 8 third-class anchorage berths, tenable probably only in northerly winds, are available. Some of the shoreline in a boat basin which has probably been completed may be quayed. There is also a small pier in 6 feet of water.

(6) *Sinp'o* (40° 01' N, 128° 12' E).

Sinp'o (Shinsho) is a small port on the east coast of Korea about 25 miles southwest of Ch'aho (PLAN 7). It is protected by the island of Mayang-do, about one mile southward, and the area between Mayang-do and the mainland forms the harbor of Sinp'o.

Sinp'o is a fishing port and is also used as a harbor of refuge. The fishing villages of Yukt'aedong-ni and Nonamtsun-ji, close westward, are nearly continuous with Sinp'o and are treated with it as one port. Four bays on the west and north sides of Mayang-do contain several smaller fishing villages. The fishing villages on Mayang-do probably provide only for local consumption; but all along the waterfronts of the villages on the mainland are small plants for the mild curing of fish, together with drying sheds and racks.

About 38 first-, 22 second-, and 23 third-class anchorage berths are available; most of the first-class berths are exposed eastward. The principal landing facilities are in the bay of Sinp'o proper; a pier at the fish meal plant can accommodate small coastal steamers; a pier on the eastern side of the bay has a head 20 feet wide in 12 feet of water. Sixty-one other piers on the mainland and 24 on Mayang-do are used by fishing craft and sampans.

(7) *Kojo-p'o (Kotei-ho)* (38° 58' N, 127° 53' E).

Kojo-p'o (Kotei-ho) is a small fishing port and refuge harbor on the east coast of Korea about 43 miles by rail south of Wonsan (PLAN 10). The harbor can provide about 16 third-class anchorage berths but depths near the entrance are sufficient to permit four of these near the entrance to be combined into 2 first-class anchorage berths. The only landing facilities are 3 small piers with 6 feet of water at their heads.

(8) *Changjon-hang (Chosen-ko)* (38° 44' N, 128° 12' E).

Changjon-hang (Chosen-ko) is a small harbor on the east coast of Korea about 68 miles south of Wonsan with which it is

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connected by rail (PLAN 11). The natural harbor is used as a base for fishing and whaling vessels and is being developed as a general harbor and a harbor of refuge. The harbor, which is protected from all winds except those from the northeast, can provide about 39 third-class anchorage berths. Of the many piers in the harbor, the Transport Pier, which has a 60-foot face in 10½ feet of water, is the only one which can berth anything larger than a fishing boat.

(9) *Taep'o-ri (Taihō-ri) and Sokch'o-ri (Tongch'o-ri)* (38° 10' N, 128° 36' E).

Taep'o-ri (Taihō-ri) is a small fishing harbor on the east coast of Korea about 122 miles south of Wonsan and 299 miles north of Pusan by rail (PLAN 11). Sokch'o-ri (Sokushō-ri, Tongch'o-ri) is another small fishing harbor about 2 miles northward of Taep'o-ri.

Taep'o-ri harbor has room for 2 first-, or 3 third-class anchorage berths. Sokch'o-ri outer and inner harbor together have room for 12 third-class anchorage berths and a lagoon entered through a 13-foot deep channel from the inner harbor has room for 6 third-class berths. Taep'o-ri has a pier in 12 feet of water, and a pier and small basin with less than 6 feet. No data are available on the existence of landing facilities at Sokch'o-ri.

(10) *Chumunjin* (37° 53' N, 128° 50' E).

Chumunjin-hang (Chūmonshin-kō) is a small bay on the east coast of Korea about 273 miles by rail north of Pusan and 148 miles south of Wonsan (PLAN 12). It is a small fishing port with 3 small piers. Between 1929 and 1936, the actual annual traffic of the port increased considerably, indicating probable development, but no data on improvements are available.

(11) *Mukhojin-ni (Bokukoshin-ri)* (37° 33' N, 128° 07' E).

Mukhojin-ni (Bokukoshin-ri) is a fishing port on the east coast of Korea (PLAN 13), and is one of the refuge harbors in the area. About 3 well-protected third-class anchorage berths are available. About 3,200 feet of open quays have depths from 4 feet to 13 feet alongside, and 10 piers have depths of about 8 feet alongside their heads. Large ships must anchor in the roadstead and work cargo by lighters.

(12) *P'ohang-dong (Hokō-dō)* (36° 03' N, 129° 22' E).

P'ohang-dong (Hokō-dō), about 100 miles north-northeast of Pusan, is a relatively important fishing harbor on the southeast coast of Korea (PLAN 14). A bay, open to the northeast, can provide about 5 first-, 18 second-, and 35 third-class anchorage berths. The landing facilities are on both sides of a river which flows into the bay near the anchorage area. Breakwaters protect the mouth of the river. The village waterfront on the left bank of the river is quayed with depths of 6 to 13 feet alongside; small piers with 6 feet of water or less at the heads are along the opposite bank. The unloading capacity of the port has been estimated at 2,500 long tons of general cargo per day discharged via lighters from 5 Libertys riding at anchor.

(13) *Kuryongp'o-ri (Kyūryūho-ri)* (35° 59' N, 129° 33' E).

Kuryongp'o-ri (Kyūryūho-ri), a small fishing port on the northeast coast of Korea, is on the north side of a semi-circular bight about 69 miles northeast of Pusan (PLANS 14 and 15).

An estimated maximum of 3 third-class anchorage berths are available in good protection but over poor holding ground. There is a pier with 17 feet of water near its head; 420 feet of open quays have 10-foot depths alongside, and 1,530 feet have depths from 2 to 4 feet alongside.

(14) *Kamp'o-ri (Kanbo-ri)* (35° 48' N, 129° 31' E).

Kamp'o-ri (Kanbo-ri), a fishing port, is in a small cove on the southeast coast of Korea about 50 miles north of Pusan (PLAN 15). An estimated 4 third-class anchorage berths are available within the harbor breakwaters. Larger vessels may anchor outside the harbor, although their is little protection. Three small piers and about 230 yards of quayage have depths from 5 to 8 feet. The estimated unloading capacity is 1,000 long tons per day worked in the stream by 2 Libertys at anchor; anchorage would be possible only when winds are moderate or lighter.

(15) *Pango-ri (Hōgyo-ri)* (35° 29' N, 129° 26' E).

The small fishing port of Pango-ri (Hōgyo-ri) is in a small bay on the southeast coast of Korea, about a mile east of the entrance to Ulsan-man (PLAN 15). Pusan is about 30 miles southwestward. Pango-ri is a base for southeast coast fishing vessels. Anchorage for 500-ton vessels is possible inside the harbor breakwaters. Vessels over 500 tons may obtain temporary, unprotected anchorage off the harbor. About 150 yards of quayage have depths up to 5 feet. A wooden pier 20 feet wide has 16-foot depths at its head and there are 4 smaller piers; all 5 piers can be used by small craft only. Deep-draft vessels anchor outside the breakwater and are unloaded by harbor craft.

(16) *Ulsan-man (Urusan-wan)* (35° 30' N, 129° 24' E).

Ulsan-man (Urusan-wan), on the southeast coast of Korea, is directly west of Pango-ri harbor and is about 35 miles north-northeast of Pusan (PLAN 15). Although little developed, it is a large anchorage, open only to the south, and providing 15 first-, 11 second-, and 40 third-class anchorage berths.

The town of Ulsan itself is 4 miles up the T'achwa-gang (river) from the coast. The river consists of mud flats and shallow water, making it impossible to load or unload at the town. Landing facilities have been developed at Changsaengp'o-ri, 4½ miles by road from Ulsan. Changsaengp'o-ri is on a narrow arm, Changsaeng-p'o (Chanshin-po), opening off the southwest side of Ulsan-man. It has about 1,250 feet of quayage with depths alongside of 6 to 13 feet. The estimated unloading capacity is 1,000 long tons, worked by lighters at Changsaengp'o-ri from 2 Libertys at anchor.

(17) *Chisep'o, Changsung-p'o, and Nung-p'o* (about 34° 51' N, 128° 44' E).

Chisep'o, Changsung-p'o (Chōshō-ho), and Nung-p'o (Ryo-ho) are 3 small bays on the east side of Koje-do, an island off the entrance to Chinhae-man on the southeastern coast of Korea (PLAN 19). They are within 3 miles of one another, and are mainly fishing harbors and harbors of refuge. Together they provide about 31 third-class anchorage berths. Nung-p'o has a pier in 28 feet of water which can accommodate vessels up to 7,500 tons. Chisep'o has a pier in 16½ feet of water and another in 11 feet. Other landing facilities in the 3 harbors are for small craft only.

(18) *Masan* (35° 10' N, 128° 33' E).

Masan is in southeastern Korea, 27 miles west of Pusan and 5 miles northwest of Chinhae, center of the Chinkai Naval District (PLAN 18). Because Masan is within the naval district, information on its port facilities is meager. Harbor and port facility improvements have been planned and some construction has been started. Masan itself extends for about 2 miles along the western bank of the harbor; a short distance northward of Masan is an older town, Kumsan. Both have landing facilities.

The protected harbor can provide about 16 second- and 41 third-class anchorage berths, and the water area southward of the harbor limit can provide about 18 first-class anchorage berths. There are no landing facilities for ocean-going vessels; depths alongside the 2 main piers are 14 and 15 feet. Facilities reported under construction may have deeper dredged depths alongside. The estimated unloading capacity is 7,500 long tons per day, serviced by lighters from the first-class anchorage berths southward of the harbor.

(19) *T'ongyong* (34° 51' N, 128° 26' E).

T'ongyong (Tōei), one of the more significant of Korea's secondary ports, is on the southern coast about 40 miles southwest of Pusan (PLAN 19). The port is a base for a fishing fleet and handles trade for the hinterland. The natural harbor, which has 3 coves, is well protected from all except east winds, and can provide about 11 first-, 15 second-, and 7 third-class anchorage berths. About 12,800 feet of quayage with depths of 6 to 10 feet are available, principally along the shores of the coves on the north side of the harbor. About 17 buildings, which either are warehouses or can be converted, provide approximately 14,000 square yards of covered storage space, and open storage areas also are available. The estimated unloading capacity of the port is 5,000 long tons per day, discharged from 10 Liberty ships unloading in the stream.

(20) *Samch'onp'o* (34° 55' N, 128° 04' E).

Samch'onp'o (Sanzenho), a large fishing center and base for the southeastern Korean fishing fleet, is about 50 miles west of Pusan on the southern coast (PLAN 19). The hinterland consists of fertile lowlands producing grain, and dry areas used for cattle raising. Exports consisted of agricultural and fishing products such as cotton, wheat, rice, soybeans, and fish; imports consisted mainly of manufactured products such as oil, sugar, drugs, and lumber.

About 4 third-class anchorage berths are available in fair protection and with good holding ground. About 1 first-, 1 second-, and 11 third-class berths are available in the roadstead, where tidal currents are strong and holding ground not good. The limited landing facilities are dry alongside at low water, and are used only by fishing craft.

(21) *Yosu (Reisui)* (34° 44' N, 127° 45' E).

Yosu, an auxiliary and alternate port for Pusan, is on the southeast coast of Korea about 75 miles east-southeastward of Pusan (PLAN 21). A small fishing village prior to 1930, Yosu has been developed since the construction of a South Manchurian Railroad Co. single-track line to Kwangju. The original construction program was designed to cover 5 years and to give the port a 500,000-ton annual freight handling capacity. However, work was still in progress as late as 1940, and more re-

cently the 1942 and 1943 Japanese Hydrographic Office notices to mariners have indicated continuing reclamation and construction.

In 1941, the port was reported in use by the Japanese Army as a staging point in the transportation of troops and supplies from Japan proper to bases in northeastern Asia. Use of the port for naval purposes has also been reported. The port is the terminal of a 9- to 10-hour sea route connecting Korea with Hakata, on Kyūshū, in Japan proper.

Yosu has 2 harbors: South Harbor, site of the old port and now used primarily by fishing vessels, and North Harbor, more recently developed as the site of the railroad company pier and construction work on other major landing facilities. North Harbor can provide about 1 first-, 5 second-, and 5 third-class anchorage berths, and South Harbor can provide 6 third-class anchorage berths. Under favorable conditions of wind and sea, additional anchorage is available in the roadstead outside of the port.

The railroad pier can berth two 4,000-ton vessels and has an estimated unloading capacity of 800 long tons per day; reports also are available that this pier has been enlarged since 1940 to accommodate two 3,000- to 10,000-ton vessels. Quayage reported to be under construction in North Harbor is scheduled to berth at least an additional four 4,000-ton vessels. Completion of this quayage would increase the alongside unloading capacity of the port to 5,200 long tons per day. South Harbor has estimated unloading capacity of 2,500 long tons per day, handled by lighters from ships at anchor.

(22) *Mokp'o (Moppo)* (34° 47' N, 126° 23' E).

Mokp'o (Moppo, Mokuho) is a treaty port of southwestern Korea; it is at the tip of the Muan-pando (peninsula) behind a fringe of islands and shoals extending approximately 35 miles seaward (PLAN 22). A modern town, Mokp'o is the administrative center of the Cholla-namdo (province) and principal outlet for the cotton and rice grown in the region.

A plant manufacturing parts for small arms is reported, and there is a factory manufacturing cottonseed oil and cellulose. Destroyers and seaplanes of the Japanese Navy have used the harbor and recent reports indicate some naval and military development.

A 50-mile-long entrance channel leads between numerous banks and islands to the port. Least depth in the channel is 34 feet; least width is 630 yards. Vessels over 6,000 tons cannot readily enter the harbor.

About 15 second-class anchorage berths are available, and 4 more second-class berths in strong currents could perhaps be used. Two 2,000-ton vessels and many boats and lighters can berth alongside the landing facilities. Steam vessels usually anchor in the stream and work cargo into lighters.

The estimated unloading capacity is 3,300 long tons per day, of which 800 tons are worked from two 2,000-ton coasters alongside, and 2,500 tons from 5 Liberty ships offshore.

A railroad and primary highway lead northward from Mokp'o. There was a regular and frequent steamship service to Dairen, Shanghai, and Japan.

(23) *Yongdangp'o (Ryūtōho)* (38° 00' N, 125° 42' E).

Yongdangp'o (Ryūtōho) is on the western coast of Korea, on the northern bank at the head of Haeju-man (PLANS 29 and 31). It is about 95 miles northwest by rail from Kyongsong, 53

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miles in a direct line southeast of Chinnamp'o, and is the port for Haeju, a town about 3 miles to the north.

Yongdangp'o serves a large rice-growing area, but it is probably more an industrial than an agricultural center. It has a large explosives factory with underground storage reported in surrounding hills; a cement plant, and an iron plant which are very close together; and a branch factory of the West Chōsen Heavy Industry Co., which manufactures mining machinery, cement-making machinery, high precision tools and small ships. Yongdangp'o is also a loading port for the low grade iron ores of western Hwanghae-do.

The entrance channel leads between drying banks for about 25 miles, and is about 21 feet deep. Several third-class anchorage berths are available. About 525 feet of quayside have depths alongside varying from 17 to 19 feet, and about 459 feet of quayside are accessible only at high tide. Vessels drawing more than 17 feet must anchor about 1½ to 2 miles off the town and work cargo by lighter.

(24) *Kyomip'o (Kenjiho)* (38° 45' N, 125° 38' E).

Kyomip'o (Kenjiho), is in northwestern Korea on the Taedong-gang (river) 16 miles above Chinnamp'o, and about 46 miles from the open sea (PLAN 31). It is the site of the Mitsubishi-owned Japan Iron Works, the largest iron and steel works in Korea. There are no landing facilities for deep-draft vessels; the few facilities available are used by lighters working cargo for the iron, steel, and coking plants.

The works has an estimated 1944 capacity of about 300,000 tons of pig-iron, and of about 150,000 tons each of steel ingots and rolled steel.

The river at Kyomip'o is frozen about the beginning of January to the middle of March.

About 4 first-, 3 second-, and 3 third-class anchorage berths are available over generally poor holding ground. The estimated unloading capacity is 2,000 long tons per day from 4 Liberty ships, at anchor.

(25) *Dasado (Taedasa-do, Tashi-tō)* (39° 48' N, 124° 25' E).

Dasado (Taedasa-do, Tashitō), a newly developed ice-free port at the mouth of the Yalu River (PLAN 34), has become an important shipping point for southern Manchuria. Formerly used merely as an anchorage for Yongamp'o, 15 miles farther up the Yalu River, Dasado has undergone extensive harbor improvements and now handles most of the cargo bound to and from the growing industrial area in the Yalu River basin, including An-tung, Sinuiju, and the Tung-pien-tao iron-ore fields. Cargo is transhipped into steel barges of 2,000 to 3,000 tons which navigate the river; cargo is also cleared by rail and road. Although Dasado is ice-free, the river upstream from Dasado is frozen from about 1 November to 1 May. There are several war industries at Dasado producing aluminum, zinc, lead, and iron. A new airplane factory is reported near Dasado. It is also reported that a military and naval base is being developed.

An entrance channel 20 miles long leads through drying banks to the port. Least depths in the entrance are not known but are probably between 3 and 4 fathoms. Anchorage is available in good protection for one 6,000-ton vessel in depths of

16 to 33 feet over mud and sand. Temporary anchorage is available 3 miles south of Taedasa-do. Three concrete wharves (650 by 130 feet), which have been reportedly completed, can accommodate three 6,000-ton vessels; 3 other wharves are probably completed. Cargo is also worked into lighters and barges from one 6,000-ton vessel at anchor.

(26) *Yongamp'o (Ryūgampo)* (39° 57' N, 124° 22' E).

Yongamp'o (Ryūgampo), about 15 miles north of Dasado (Taedasa-do, Tashi-tō) on the Yalu River (PLAN 34), is reported to be the site of a new industrial area constructed on newly reclaimed land. A lead smelter owned by the Sansei Mining Company is located here, and an arsenal and explosives factory are reported under construction.

Ice closes the port from about 1 November to 1 May.

Vessels of between 1,000 and 2,000 tons, drawing not more than 13 feet, can anchor about 1½ miles from Yongamp'o and work cargo into lighters. Steel barges of 2,000 to 3,000 tons receive cargo from larger vessels at Dasado, and carry to Yongamp'o and Sinuiju - An-tung; at Yongamp'o they probably work cargo into lighters. There is one pier which can be used at high tide by small craft.

(27) *Sinuiju (Shingishu) - An-tung* (40° 6' N, 124° 24' E).

The twin cities of Sinuiju and An-tung are on opposite banks about 17 miles above the mouth of the Yalu River, the boundary between Korea and Manchuria. Yongamp'o is near the mouth of the river and Dasado (Taedasa-do) is southward of the mouth. Sinuiju - An-tung is a major lumber and paper center, and an important railroad shipping point. Timber from the Yalu River valley is milled and shipped. War industries in the area produce light metals, chemicals, explosives, and alcohol. As a railroad gateway between Korea and Manchuria, Sinuiju - An-tung have large railroad marshalling yards and railroad repair facilities. Two railroad bridges span the river and connect the cities. Extensive facilities for repairing and constructing small craft are available.

There are scattered shoals in the river harbor, and the irregular depths range from 3 to 15 feet. Access to the harbor is limited to coasters of less than 1,000 tons drawing 12 feet or less. The mouth and estuary of the river are encumbered with sand and mud banks. Large vessels anchor in the estuary of the river, near Dasado (Taedasa-do) and transship cargo to and from Sinuiju - An-tung via 2,000- to 3,000-ton steel barges. Ice closes the river to navigation from the last of October to 1 May; vehicles travel on the ice during some of this time.

The waterfront along both banks of the river has been quayed or bulkheaded for a total length of 11,900 feet. The principal quays and warehouses are on the An-tung bank. Berthage is provided for small coasters and 2,000- to 3,000-ton steel barges. At least 64 known warehouses provide about 777,750 square feet of covered storage; extensive open storage facilities are available to handle lumber, the port's chief cargo. Several basins, one of which is part of a lumber company compound, and several small boatyards provide over 200 slipways for small craft. Some may be used for unloading logs and handling lighters during the ice season.

7. Transportation and Telecommunications

A. Transportation.

(FIGURE I - 23)

(1) Railroads.

(a) *Pattern.* It is estimated that there are now about 4,700 miles of both government-owned and private railroad lines in Korea. The pattern, designed to answer strategic needs, is predominantly north-south, reflecting the position of Korea between Japan and the Asiatic continent. Two trans-peninsular routes cross the mountain backbone, connecting the east and west coast railroad lines. During the years 1941 to 1945 constant construction has been reported, as attempts are being made to supply an alternative route for every section of line.

The most populous part of Korea is along the western plain. The hub of commerce and industry, as well as of the railway network, is Kyongsong (Keijō Seoul). Along the west coast runs the most important railway, linking Japan, Korea, Manchuria, and North China. This rail route carries the Korea section of the Asia Express. During the war freight traffic has increased on this line, as goods formerly carried by ship have been diverted to rail transport. There is steamer service between Pusan (Fusan), the terminus of the main rail line in Korea, and Shimonoseki, Japan.

The North Korea lines have assumed growing importance as carriers of both military supplies and the products of the newly developed resources and industries of North Korea. Trans-peninsular traffic has also increased appreciably between the industrial and commercial centers of Kyongsong and P'yongyang (Heijō), on the west coast, and the mining, lumber, and industrial areas of North Korea.

(b) *Administration.* All through lines are owned and operated by the government, with the exception of the North Korea lines, which are leased to the South Manchuria Railway Company. Privately owned railroads are principally industrial feeder lines and interurban tramways. Those private lines which can be extended to become through lines are being purchased by the state.

The Chōsen Government Railways were controlled by a separate bureau until October 1943, when all land and water transportation was combined into one bureau of the Government-General. The central Bureau office is in Kyongsong (Keijō), although management is divided into 3 regions or districts, with their offices in Kyongsong, Pusan (Fusan), and Hamhung (Kankō).

As in all parts of the prewar Japanese Empire, the railway system of Korea has been efficiently operated. There is a certain amount of supervision of operation practices by the Department of Railways in Japan, although policies are governed by the Japanese War Department through the Government-General.

All administrative and supervisory positions are held by Japanese, Koreans being employed mainly as technicians and laborers. The ratio of laborers to skilled and administrative workers is high, as efficiency has depended largely upon the amount of labor employed rather than upon the use of machinery.

(c) *Track.* The standard gauge of the Korean railroads is 4'8½". There is a small mileage of 2'6" gauge, mostly on private feeder lines. The main west coast Pusan - Sinuiju (Shing-

ishū) line is almost entirely double-track, and portions of the North Korea lines are double-track. All other lines are single-track.

Motive power is predominantly steam. Two private lines and a portion of the Kyongwon trans-peninsular line are electrified. It is possible that more of the government lines have been electrified in recent years, especially in mountainous sections.

The west coast trunk line has a maximum gradient of 1 percent. Branch lines vary from 1.6% to 3.3% in switchback areas, which are found in most mountain lines. The minimum radius for curves on standard gauge lines is stated to be 1,000 feet, but there are probably many sharper curves.

Roadbed is well built and maintained, with ballast of crushed rock and river gravel. Rails are spiked or screwed directly to ties which are an assortment of hardwoods, creosoted only on the trunk line. Rails vary from 100 pounds per yard on the main line to 33 pounds on narrow-gauge lines.

Train operations follow the Japanese tablet block system, signals being semi-automatic on the main line and hand-operated on branch lines.

(d) *Bridges and tunnels.* Bridges and tunnels are numerous. A great proportion of the bridges are of steel truss construction. On the main line most of the bridges have been duplicated. The bridges at Sinuiju (Shingishū) over the Yalu River and at Kyongsong (Keijō) over the Han-gang are particularly important for their positions on the main line, as well as for their lengths (3,097 feet and 2,067 feet respectively). Tunnel areas in northern and central Korea frequently have about 2 to 3 tunnels per mile. The longest known tunnel, 2.3 miles long, is between Najin (Rashin) and Unggi (Yūki). There are reports of 2 other tunnels about 3.5 miles long near Sup'ung-dong (Suihō-do) on the border, and near Sinup (Shinyū) on the P'yongyang - Wonsan (Heijō - Genzan) line.

(e) *Rolling stock.* It is estimated that there are about 650 locomotives, 2,000 passenger cars, and 8,000 freight cars on the Korean railways. They are generally of American type. Passenger engines are mostly 4-8-2 and 4-6-2 class: the 4-6-0, 4-4-0, 2-8-0, and 2-8-2 are used for mixed and freight trains. The 2-8-2, used extensively for freight, weighs, with tender, 120 tons, and has a tractive effort of about 38,800 lbs.

It is reported that all passenger cars have 4-wheel bogie trucks. First-class sleeping cars are now used only on the trunk line, with third-class coaches and some second-class sleepers on other lines. Passenger cars are being converted to freight cars to increase capacity for freight traffic.

Freight car capacity varies from 15 to 50 tons, 20 to 30 tons being in general use on the government railways. Those of 30-ton capacity and over are of the 4-wheel bogie type. There are about an equal number of box and open-type cars, with some special types such as refrigerator and cattle cars.

(f) *Shops and yards.* The most important workshops in Korea are at Yongsan (Ryūzan), the southern suburb of Kyongsong (Keijō). These shops and 3 others at Pusan (Fusan), P'yongyang (Heijō), and Ch'ongjin (Seishin) build new units as well as repair locomotives and rolling stock. Other important repair shops are at Sinuiju (Shingishū), Chongju (Teishū), Taidon (Taiden), Taegu (Taikyū), Wonsan (Gensan), Najin-dong (Rashin-da), and Songjin (Jōshin). Roundhouses and engine sheds are located every 40 to 100 miles.

The largest yards are grouped around Kyongsong and P'yongyang. At Kyongsong are the Yongsan (Ryūzan) yards on the

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south, Susaeng-ni (Suishoku-ri) on the west, and Ch'ongyang-ni (Seiryō-ri) on the east. At P'yongyang are the P'yongyang yards on the south of the city, and Sop'o (Seiho), about 5 miles north. Other classification yards are at Taejon and Wonsan. There are extensive terminal facilities at Ch'ongjin, Najin, Wonsan, Pusan, Mokp'o (Moppo), Inch'on (Jinsen), Chinnamp'o, and Dasado (Tashitō).

(g) *Traffic.* During the war, transit traffic through Korea has been increasingly supplementing local traffic. The heaviest movement is on the Pusan-Sinuiju trunk line. It is estimated that a total of about 30,000,000 tons will be carried on the Korean railways in 1945. Principal commodities are mining and industrial products, military supplies, grains, railway materials, and lumber. Restrictions on passenger travel have been broad and apparently effective, and in conjunction with other measures have improved the freight-carrying capacity of the railroads in the last few years. It is believed that the present capacity can be appreciably increased only by the addition of locomotives.

(h) *Vulnerability.* The railways of Korea have several especially vulnerable features. Loss of rolling stock, particularly locomotives, would seriously cripple movement of goods. On the main line are many large and strategic bridges. At P'yongyang (Heijō) and at Kyongsong (Keijō) are major bottlenecks, where bridges, yards, and workshops are within about 1/2 mile radius of each other. Along mountainous sections of branch lines, landslides and washouts are common, and tunnel areas are numerous.

(2) Roads.

When the Japanese assumed control of Korea, motor vehicles had not yet come into common use, and the roads were little more than cart tracks and trails. New roads have been built and others improved as part of the general program to develop Korea and its resources, with military considerations playing an important part in the formulation of the plans. During recent years there appears to have been a concentration of effort on through routes which might prove valuable as arteries for the movement of military supplies and mechanized equipment, and as supplements to the railway system in transporting all kinds of goods.

The main highways center at Kyongsong, forming a large X that extends cross-country from Sinuiju to Pusan, and from Onsong (Onjō) to Mokp'o (Moppo) by way of Wonsan (Genzan). Other important roads parallel the Manchurian boundary, and follow a short distance inland along the south coast. Other motorable roads are numerous in the lowland area of western Korea, and provide routes across the more mountainous sections.

Roads formerly called first-, second-, and third-class are now state, local, prefectural, or township and village roads, following a reclassification in 1938. State roads are built at national expense and are generally well maintained, stone-based roads of 2 or 3 lanes (civilian traffic). Local roads, built by provincial governments with the aid of subsidies, are generally motorable, though varying considerably in width and maintenance. Motorable roads are generally of traffic-bound macadam, or are well graded earth roads with a thick topping of broken rock. Hard-surfaced roads are not common, except in and near the larger cities, and between major cities and their ports (Kyongsong - Inch'on, Chonju - Kunsan).

Most motorable roads are thought to be supplied with

bridges over the major streams (although many bridges can carry loads of only 3 to 5 tons). The first large bridges built were of steel through-truss construction with narrow roadways. These were being supplemented or replaced, usually by reinforced concrete bridges. Perhaps the most important river crossing in the country is at Kyongsong, the hub of the road system, where there are said to be 3 highway bridges across the Han-gang.

Heavy rains during July and August cause considerable disruption of traffic. The southern part of the country suffers most from these seasonal rains, though roads are generally built on embankments through the rice fields. Traffic on through routes is seldom affected except by damage to small bridges and culverts. Landslides and washouts are fairly common in the mountainous section, but main routes are generally protected by well-built retaining walls and stone-faced banks. Snow occurs throughout Korea but is unimportant as an obstacle to traffic, except in the northern mountains, where the roads may be blocked for a day or two until cleared by plows.

Because of Korea's rugged terrain, roads tend to follow valleys. To avoid flood dangers, however, they generally follow the valley wall or hug the hillsides rather than the valley floors. Deployment is difficult in such regions as well as in the more level sections, where considerable areas are devoted to rice paddy.

The only extensive forest areas in Korea are in the north, where there are considerable stretches of dense growth. Other forests are scattered along the eastern and southwestern highlands. For the most part, vegetation is not a serious obstacle to deployment from roads. There is little dense undergrowth in the forests. In populated regions, where most of the land is under cultivation, cover for mechanized units is limited by the scarcity of trees and brush.

The use of motor vehicles in Korea has been chiefly for business purposes. The total number of motor vehicles, including passenger cars, buses, and trucks was only 9,500 in 1939, and has been declining during the war years because of the difficulty of effecting repairs and replacements. Buses, ranging in size from station-wagons to thirty-passenger vehicles, were used extensively, covering approximately 80% of the total mileage of state and local roads. Light trucks were also used, generally for short hauls. Some buses and trucks have been confiscated for military use and there is reason to believe that all vehicles are being used for much longer runs than formerly, in order to supplement the railroads.

The planning and financing of highways, previously under the Civil Engineering Department of the Bureau of Internal Affairs of the Government-General, is believed to be under a coordinated Communications Bureau since the reorganization in 1943.

(3) Waterways.

A large tonnage of freight is transported by sea, and traffic on the inland waterways is relatively insignificant as few streams are navigable. Local coastwise trade is carried largely by junks and small motor vessels. The heavy trade to and from Japan is handled principally by steamers. Imports consist chiefly of military supplies, bituminous coal, fertilizers, textiles, and machinery; exports include rice, soya beans, anthracite coal, lumber, mineral ores, and chemical and marine products. Except at Chinnamp'o, where maritime activity usually decreases

in winter, the greatest volume of shipping is normally carried in late fall, winter, and early spring. Practically no steamship lines operate on a regular schedule, aside from the Pusan - Shimonoseki ships operated by the Japanese Imperial Government Railways. In 1938, 13,062 steamers aggregating 14,167,000 gross tons entered Korean ports. Of these, 11,640 steamers, totalling 12,230,000 gross tons were Japanese-owned. Motor vessels under Korean registry in 1939 totalled 673 with an aggregate of 99,188 gross tons. Sailing vessels under Korean registry in 1938 totalled 1,096 with an aggregate of 42,715 gross tons.

Most of the small Korean ports and fishing harbors, which number over 300, are on the greatly indented south and west coasts. However, the Japanese have developed several ports on the east as well as on the south and west coasts primarily to serve Japanese shipping. The most important of these are Unggi (Yüki), Najin (Rashin), Ch'ongjin (Seishin), Songjin (Jōshin), Hungnam (Kōnan), Wonsan (Gensan), Pusan (Fusan), Masan, Yosü (Reisui), Mokp'o (Moppo), Kunsan (Gunzan), Inch'on (Jinsen), and Chinnamp'o. Additional details on ports are given above in Topic 6.

Routes parallel the entire coastline, and connect the Korean ports with Japan, Manchuria, and China. The most important route joins Pusan and Shimonoseki. Other major routes are:

Northeast coast ports to Japan (Niigata, Fushiki, Kanazawa, and Tsuruga); Pusan to west-coast ports (Mokp'o, Kunsan, Inch'on, Chinnamp'o, Dasado (Tashitō), and Yongamp'o); and Pusan to northeast-coast ports (Wonsan, Hungnam, Najin, and Unggi). In addition, there are numerous minor coastal lines which call at many small ports and islands en route and serve as feeder lines to the main ports.

Navigation and closely related activities are under the administration of the Communications Bureau of the Government-General of Chōsen.

Only one river on the east coast (Tuman) and one on the south coast (Naktong) are navigable for any appreciable distance inland. Important rivers on the west coast (Kum, Han, Taedong, Ch'ongch'on, and Yalu) however, tend to be longer and less swift in their middle and lower courses, and have channels more suitable for navigation. Nearly all Korean streams are frozen at least part of the winter, and are subject to floods after periods of heavy rainfall. Barges, launches, junks, and rafts are the commonest types of river craft. Chief cargoes are timber, agricultural produce, coal, salt, marine products, and general merchandise.

B. Telecommunications.

(FIGURE I - 24).

Korea's telecommunications facilities play an important part in Japanese expansion on the mainland of Asia. They are essential in the administration of government, for military purposes, in the development of Korean resources, and as connecting links between Japan and Manchuria.

All telecommunications are operated or licensed by the Communications Bureau of the Government-General of Korea. Radiobroadcasting is a monopoly of the Broadcasting Corporation of Korea (Chōsen Hoso Kyokai), which is closely affiliated with the Broadcasting Corporation of Japan.

Kyongsong is the chief center of telecommunications in Korea. Other important centers are Pusan, Sinuiju, Wonsan, Mokp'o, and P'yongyang.

(1) Radio.

Radiobroadcasting is one of the government's chief means of issuing official statements and propaganda. The Broadcasting Corporation of Korea operates at least 7 stations, which are distributed regionally to make reception possible everywhere in Korea. These stations are in Kyongsong, Ch'ongjin, Pusan, Hamhung (Kankō), I-ri (Ri-ri), P'yongyang, and Taegu (Taikyū). All domestic broadcasting is censored, and ownership or use of short-wave receivers is prohibited. A large proportion of programs are in Japanese and many of them are relayed from Japan; most of the Korean language programs originate in Kyongsong. The other Korean stations rebroadcast most of their programs from these two sources.

Most of the 220,000 home receiving sets licensed in 1941 were 3- or 4-tube table models. In 1940, 56% of all Japanese households in Korea had radios, while less than 2% of Korean households were equipped.

Radiotelegraph has developed in Korea under the influences of several factors: the importance of coastal shipping, the growth of aviation, and the use of point-to-point radiotelegraph. The Japanese Army and Navy have also favored radiotelegraph because it is more adaptable than land telecommunications. International or overseas radiotelegraph has not been fostered by the Japanese in Korea. Most overseas telegraph messages are routed by submarine telegraph cable from Pusan to Japan, where direct radiotelegraph circuits were maintained in peacetime with leading cities of America, Europe, and Asia.

Radiotelephone circuits provide service primarily for official communication. Radiotelephone stations are at Ch'ongjin, P'ohang-dong (Hokō-do), Oryuk-to (Goroku-tō) in Pusan-hang, Sinuiju, and Kyongsong. Much of the demand for radiotelephone equipment has come from the growth of commercial and military aviation between Japan and the mainland. International or overseas radiotelephone service is routed by submarine telephone cable from Pusan to Japan.

(2) Land telegraph.

Korea's land telegraph network has been extended to all parts of the country to conform with administrative, commercial, and industrial needs. In recent years, however, a shortage of equipment has caused serious curtailment of telegraph service, and priorities have been established for transmission of telegrams.

Telegraph routes usually run parallel to railways and main highways. All important towns have telegraph service, and there are also lines to Manchuria and China. Main routes were as follows: Pusan, Kyongsong, Sinuiju, Manchuria, and China; Kyongsong, Wonsan; Pusan, Wonsan, Ch'ongjin, and Unggi (Yüki); Kyongsong, I-ri, and Mokp'o; and P'yongyang, Manp'ojin (Mampochin), and Manchuria. At Pusan at least 6 submarine cables link Korea with Japan for overseas telegrams.

(3) Telephone.

Public use of telephones has never been extensive in Korea. In 1939, only 53,306 telephone subscribers were reported for a population of over 22,000,000. However, the telephone system extends throughout Korea, and important cities have telephone circuits connecting with Manchuria, China, and Japan. The shortage of telephone equipment has become serious in recent years. In general, telephone routes follow the pattern of the telegraph network. One of the most important tele-

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phone installations is the section of the Tōkyō - Mukden telephone cable completed in 1940. It was laid underground from Pusan to Sinuiju alongside the railway.

(4) Submarine cables.

At least 10 submarine cables connect Korea with Japan, and include through-circuits between Japan and Manchuria. They are supplemented by radiotelegraph and radiotelephone.

Six cables from the vicinity of Pusan land near Shimonoseki, Japan. Five of these are telegraph circuits to Yoshimi, and the other is a telephone cable to Murotsu. There are also telegraph and telephone cables between Pusan and Yubuko (near Saga), Japan, via Tsushima and Koje-do (Kyosai-tō) is linked to Tsushima by at least 2 telegraph cables. Another telegraph cable connects Wonsan, Korea, and Chikumi (near Matsue), Japan, via Ullung-do (Utsuryō-tō).

8. Cities and Towns

A. General description.

The urban population of Korea is small (14% of the total population in 1937) compared with that of more industrialized countries, but has increased rapidly in recent years. The cities, which are mostly on or near the coast, are most numerous in the south and fewer toward the north (FIGURE I - 25). The greatest concentration of urban population is in west-central Korea, which contains the 2 largest cities, Kyongsong (Keijō) and P'yongyang (Heijō). The cities and towns here described are divided into 4 groups—southern, west-central, northwestern, and northeastern—and are treated in that order. Korean names are given first, followed by Japanese names in parentheses.

Most of the cities and large towns are either ports or inland commercial centers. The other cities are industrial, military, naval, transport, or mining centers, with the exception of Kyongsong, P'yongyang, and Sinuiju (Shingishū), which are highly diversified.

The Korean and Japanese sections of most cities are sharply differentiated. The former have narrow, crooked streets and irregular blocks densely covered by small houses with thatched or tile roofs. Japanese sections have more regular street patterns and somewhat larger houses of wood or wood-and-plaster.

Schools, hospitals, and governmental offices are usually large, substantial structures suitable for billeting. Modern factories and warehouses and large stores have been built in the larger cities, but much of the trade and industry is still carried on in private houses.

Among the utilities, only electric power is widely distributed. Water systems, although present in nearly all cities, have few outlets to individual consumers; public hydrants are the usual provision. Although telephone and telegraph lines form elaborate networks over Korea, service is available only to officials, large concerns, and the wealthy. Local transportation is largely confined to bicycles, rickshas, and carts; motor vehicles are rare.

Of the 34 cities and large towns described, 7 have a population greater than 100,000, and 8 others have between 50,000 and 100,000. The Japanese, who are concentrated in urban areas, form between 10% and 20% of the population of most cities.

B. Southern Korea.

Nearly half the population of Korea is in the 6 densely settled southern provinces. The area is largely agricultural, and the cities are chiefly inland commercial centers or rice-shipping ports. Pusan (Fusan) overshadows all others in importance; it is the port nearest Japan and the terminus of Japan's land route to Manchuria and China.

(1) Pusan (Fusan; 1940 population: 249,734).

Pusan, on the southeast coast, is the third largest city in Korea; its great strategic importance lies in its proximity to Japan (it is 120 miles from Shimonoseki), its excellent port facilities, and the double-track railroad leading across Korea to connect with the Manchurian and Chinese rail systems. The city is increasing in importance as an industrial center and is the provincial capital of Kyongsang-namdo (South Keisho). Most cables from Japan to Korea are landed at Pusan.

In addition to the double-track Pusan - Kyongsong - Mukden rail line, an alternative line runs to Kyongsong by way of Andong (Antō). Roads extend northwest to Kyongsong and north along the east coast to Wonsan (Genzan). A large airfield is 5 miles to the northeast.

Pusan's major industrial establishments are a machinery manufacturing company and a shipbuilding company. The estimated total area of warehouse space is 2,239,900 square feet.

Repair facilities include shipbuilding yards, railway repair and construction shops, machine shops, foundries, and garages.

(2) Chinhae (Chinkai; 1937 civilian population: 18,988).

Chinhae, about 25 miles west of Pusan, is the leading naval base in Korea, and guards the Chōsen-kaikyō (strait). Primarily a mine depot and training area, it is also suitable for a destroyer base. Installations include a torpedo loading plant, a naval air station, oil and coal storage, minor repair facilities, a power plant, a radio station, barracks, and officers' quarters. A railroad and a primary highway extend to Ch'angwon (Shōgen) on the south coast railroad and highway.

(3) Masan (1940 population: 36,429).

Masan, 30 miles west of Pusan, is a south coast port which is being developed to supplement Pusan. It is connected with the south coast railroad and highway. Facilities include warehouses, barracks for an artillery regiment, a hospital, a water system, and power and ice plants. Marine repairs can be made at a drydock and 3 patent slips.

(4) Yosu (Reisui; 1937 population: 31,259).

Yosu, centrally located on the south coast, is another port supplementary to Pusan; it has good rail connections with the interior and is being used increasingly as a military port. The single-track Yosu - I-ri (Ri-ri) rail line crosses the south coast line at Sunch'on (Junten) and meets the west coast Honam (Konam) line at I-ri. A secondary road connects with Pusan.

Extensive warehouses are in the new town, and an oil-storage area and other warehouses are in the old town. Power is furnished by a hydroelectric plant at Posong (Hōjō).

(5) Sunch'on (Junten; 1937 population: 23,462).

Sunch'on is a rail and road junction and local trade center 25 miles northwest of Yosu. The Yosu - I-ri rail line crosses the south coast line at Sunch'on; and roads lead north to Chonju (Zenshū), south to Yosu, west to Kwangju (Kōshū), and

northeast and southwest along the coast. Power is supplied from a hydroelectric plant near Chonju.

(6) *Mokp'o (Moppo; 1940 population: 64,256).*

Mokp'o, a significant port in southwestern Korea, ships large quantities of rice to Japan; it is also a fishing center and the terminus of the Honam (Koham) rail line, which connects with the Pusan - Kyongsong - Mukden line at Taejon (Taiden). A primary highway leads to Kyongsong, and secondary highways connect with points in southern Korea. A landing ground is reported nearby.

Mokp'o has a number of small factories. Warehouses, chiefly for rice and cotton, line the waterfront, and oil storage facilities are available. Repair facilities include a small shipbuilding yard, railroad shops, and small machine shops.

(7) *Cheju (Saishū; 1939 population: 37,500).*

Cheju, a small port on the northern coast of Cheju-do (Saishū-tō; island), is the largest town and the administrative center of the island. The town has an artificial harbor and is on a coastal road encircling the island and a road leading to the interior; there is a landing ground about 1 mile to the west. The island is chiefly important as an air base between Japan and most of the China coast.

(8) *Kwangju (Kōshū; 1940 population: 64,520).*

Kwangju, the largest city in southwestern Korea, is a highway center and the provincial capital of Cholla-namdo (South Zenra). It is on the south coast rail line near its junction with the north - south Honam line; a branch line runs 12 miles north to Tamyang (Tanyō). The north - south Mokp'o - Kyongsong highway is crossed at Kwangju by an east - west road from Sunch'on to Popsongp'o (Hoseiho); another road extends northeast to Kumch'on (Kinsen) on the main Pusan - Kyongsong highway. Kwangju's facilities include small warehouses, barracks and about 20 schools for billeting, 2 hospitals, and water and power systems.

(9) *Kunsan (Gunzan; 1940 population: 40,553).*

Kunsan, on the west coast about 100 miles south of Kyongsong, is an important rice-shipping port and has several new industries. A rail line runs east to the north - south Honam line at I-ri, and a highway runs east to the Kyongsong - Mokp'o highway at Chonju (Zenshū). From the vicinity of Changhang-ni (Chōkō-ri), directly across the mouth of the Kumgang (Kin-kō; river), a rail line and a highway run directly to Kyongsong. A landing ground is reported in the area.

Factories include the Chōsen Refining Company (possibly an important copper producer in Changhang-ni), the Japan Diesel Company (diesel motor parts), and the Chōsen Metal Company (mining machinery, small ships). Warehouses line the waterfront and are being expanded. The main source of power is a hydroelectric plant near Chonju.

(10) *I-ri (Ri-ri; 1937 population: 21,335).*

I-ri, 13 miles east of Kunsan, is an important rail junction. The Honam rail line from Mokp'o to the Pusan - Kyongsong main line is met at I-ri by branches from Kunsan and from Yosū (Reisui) on the south coast. A secondary road connects with the Kunsan - Chonju highway. An emergency landing ground is nearby. A hydroelectric plant near Chonju supplies power.

(11) *Chonju (Zenshū; 1940 population: 47,230).*

Chonju, the provincial capital of Cholla-pukto (North Zenra), is an important highway junction 30 miles northeast of Mokp'o, and a local trade center. The Mokp'o - Kyongsong highway crosses the east - west Sunch'on (Juntan) - Kunsan (Gunzan) highway here, and the Yosū (Reisui) - I-ri (Ri-ri) rail line passes through the city. An emergency landing field is 2 miles northwest.

Factories include a hemp textile plant, now reported to be making explosives, and a tobacco factory. A hydroelectric plant in the mountains southeast of the city supplies power.

(12) *P'ohang-dong (Hokō-dō; 1937 population: 15,250).*

P'ohang-dong, a fishing settlement, is the chief east-coast port between Pusan and Wonsan (Genzan). The town is connected by rail and road with Pusan and Taegu (Taikyū) and by road with Wonsan. P'ohang-dong has several small food industries, a quarantine hospital, and several schools.

(13) *Taegu (Taikyū; 1940 population: 178,923).*

Taegu, the largest interior city in southern Korea, is a commercial and transportation center and the provincial capital of Kyongsong-pukto (North Keisho). It is on the double-track Pusan - Kyongsong - Mukden rail line and is connected by a branch with the alternate Pusan - Kyongsong line. Primary roads extend southeast to Pusan, northwest to Taejon (Taiden), and north-northwest to Ch'ungju (Chūshū); secondary roads reach south to Masan and east to P'ohang-dong. An airfield and an emergency landing ground are near the city. Repair facilities are limited to small machine shops, foundries, and garages.

(14) *Taejon (Taiden; 1940 population: 45,541).*

Taejon, the provincial capital of Ch'ungch'ong-namdo (South Chusei), is a major rail junction and an important inland commercial center. At Taejon the double-track Pusan - Kyongsong - Mukden line meets the Honam (Konam) line to Mokp'o (Moppo), and the Pusan - Kyongsong highway passes through the city. An airfield is reported 5 miles to the northwest.

Industries include a plant making piston rings and a hemp textile mill. Warehouses are along the main rail line, and 2 barracks areas are west of the city. There are railroad repair shops in the northeastern section.

(15) *Ch'ongju (Seishū; 1937 population: 30,143).*

Ch'ongju, the provincial capital of Ch'ungch'ong-pukto (North Chūsei), is an inland commercial center 75 miles south of Kyongsong. It is on rail and highway branches connecting with the main Pusan - Kyongsong routes.

C. West-central Korea.

The 3 west-central provinces, dominated by the 2 largest cities, Kyongsong and P'yongyang (Heijō), constitute the economic and political center of Korea. They support a moderately dense agricultural population and have had a rapid industrial growth based on local mineral resources and hydroelectric power from northern Korea.

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(1) *Kyongsong (Seoul or Keijō; 1940 population: 935,464).*

Kyongsong, the capital and largest city of Korea, is the hub of the main railroads and highways and is a major industrial, military, and communications center. Much of its most recent development has been in the 2 southern suburbs of Yongsan (Ryūzan) and Yongdungp'o (Eitōhō) and along the rail line to the port of Inch'on (Jinsen).

The major rail lines entering the city are the double-track Pusan - Kyongsong - Mukden and Kyongsong - Inch'on lines, the alternate line to Pusan, and the line to Wonsan and the northeast coast. Main highways generally parallel the rail lines. Two airfields are southwest of the city.

The Yongsan (Ryūzan) railroad shops, the Ryūzan Manufacturing Company (a major producer of railway equipment and other heavy machinery), most of the warehouses, and a large barracks area are all in the Yongsan (Ryūzan) section. There are extensive railway repair facilities, machine shops, and garages.

(2) *Inch'on (Chemulpo or Jinsen; 1940 population: 171,165).*

Inch'on, the port of Kyongsong, is a major port and industrial center, and the fourth largest city in Korea. The city is connected with Kyongsong by rail and highway, and a narrow-gauge railroad runs southeast to Suwon (Suigen) and Yoji (Reishū).

Several large industrial plants making special steel, railroad rolling stock, and mining machinery are in Inch'on. Extensive warehouse facilities border the tidal basin and other parts of the waterfront, and naval supplies are stored on Wolmi-do (Getsubi-tō; island). Repair installations consist of 2 ship-building plants, a railroad equipment plant, and machine shops.

(3) *Kaesong (Songdo or Kaijō; 1940 population: 72,062).*

Kaesong, an old Korean city little modified by the Japanese, is on the Pusan - Kyongsong - Mukden railroad 35 miles north of Kyongsong; it is the center of the ginseng industry. It has many warehouses, a waterworks, and a steam plant.

(4) *Haeju (Kaishū; 1940 population: 62,651).*

Haeju, the provincial capital of Hwanghae-do (Kōkai-do), is a commercial and industrial center 80 miles northwest of Kyongsong. A new cement plant has been developed at its port, Yongdangp'o (Ryūtoho), 3 miles south. Haeju is connected by branches to the rail line and highway between Kyongsong and P'yongyang. An airfield is located southeast of the town. The leading industries are cement, mining machinery, explosive plants, and a refinery for gold and possibly other ores.

(5) *P'yongyang (Heijō; 1940 population: 285,965).*

P'yongyang, the second largest city in Korea, is a leading industrial center and the site of the second largest arsenal on the Asiatic mainland and of the chief Korean air base. A large army garrison is maintained in the city, which is the provincial capital of P'yongan-namdo (South Heian) and has been a leading cultural center for centuries.

P'yongyang is on the Pusan - Kyongsong - Mukden railroad. Other lines lead to Chinnamp'o and to industrial installations

east of the city, while branches of the main line lead to Wonsan on the east coast and to central Manchuria by way of Manp'ojin (Mampochin). Roads generally follow the railroads. The main airfield is in the northeastern section.

In addition to the arsenal, there are plants producing aircraft parts, mining machinery, cement, alcohol, and rubber goods. Warehouses and oil storage areas border the banks of the Taedong-gang (Daidō-kō). The city has railroad and street-car repair shops, machine shops, and several garages.

(6) *Chinnamp'o (Chinnampo; 1940 population: 68,676).*

Chinnamp'o, the port for P'yongyang, is one of the leading Korean ports and has chemical and non-ferrous metallurgical industries. It is connected by rail and road with P'yongyang and with small nearby points. Leading industries are an aluminum and magnesium plant, a smelter, and a chemical plant. Warehouses and coal storage areas are along the waterfront, and there are several oil storage areas in the northern part of the city.

(7) *Kyomip'o (Kenjibo; 1939 estimated population: 25,000).*

Kyomip'o, 19 miles south of P'yongyang on the Taedong-gang, is the site of the Japan Iron Works, one of the major heavy industrial plants in Korea. It is on branches of the Pusan - Kyongsong - Mukden railroad and the Kyongsong - P'yongyang highway. An emergency landing field is reported near the town. It is entirely dominated by the ironworks, which produces a major share of Korean pig iron and steel.

D. Northwestern Korea.

The northwestern province of P'yongan-pukto (North Heian) is a sparsely settled frontier-like region. Most of its population occupies a coastal strip, where the 2 chief centers, Sinuiju (Shingishū) and Chongju (Teishū), are located. Lumbering, mining, and new industries based on abundant hydroelectric power supplement the meager agricultural development.

(1) *Sinuiju (Shingishū; 1940 population: 61,143).*

Sinuiju, the provincial capital, and its larger Manchurian neighbor, An-tung, form an urban complex near the mouth of the Amnok-kang (Oryoku-kō or Yalu River). Yongamp'o (Ryūgampo or Ryusen) and Dasado (Tashitō), downstream from Sinuiju, are associated with it. The Pusan - Kyongsong - Mukden railroad crosses the river on 2 bridges. Roads lead southeast to P'yongyang and up the river valley, and Manchurian highways lead from An-tung to Mukden and Dairen. Two landing fields are near the city.

The major industrial plants in Sinuiju, Yongamp'o, and Dasado produce alcohol, aluminum, magnesium, paper, castings, and possibly steel. The city is an important lumber market and the site of several large sawmills. Most of the warehouses are in An-tung or in Dasado. An-tung has large railway repair shops, and there are smaller shops in Sinuiju, as well as small marine repair facilities and several garages.

(2) *Chongju (Teishū; 1937 population: 12,502).*

Chongju, midway between Sinuiju and P'yongyang, is a rail junction and has important railroad shops. The Pusan - Kyongsong - Mukden rail line is met at Chongju by a branch

to the Suiho dam on the Amnok-kang; the P'yongyang - Sinuiju highway passes near the town.

E. Northeastern Korea.

The sparsely settled provinces of Hamgyong-namdo (South Kankyō) and Hamgyong-pukto (North Kankyō) have recently had a rapid development of industrial plants and transport facilities. Direct rail connections with central Manchuria have spurred the growth of several ports, and abundant power and mineral resources have encouraged the establishment of chemical and metallurgical plants. A large military establishment guards the Russian frontier.

(1) Wonsan (Genzan; 1940 population: 79,320).

Wonsan, on Yonghung-man (Eiko-wan; bay) 115 miles northeast of Kyongsong, is the east coast terminus of the easiest route across the peninsula. It is a port and naval base, a road and rail focus, and a petroleum refinery center. Railroads and highways extend to Kyongsong, P'yongyang, and Ch'ongjin (Seishin); the east coast rail line runs only as far as Samch'ok (Sanchoku), but the east coast highway extends to Pusan. A naval air base is at the southeastern end of the city.

The main industrial plants are 3 petroleum refineries, a smelter, and an aluminum plant. Warehouses line the waterfront, and oil storage tanks with a capacity of more than 1,000,000 barrels are in the refinery areas. There are railroad shops, small shipyards, and several garages.

(2) Hamhung (Kankō; 1940 population: 75,320).

Hamhung, the provincial capital of Hamgyong-namdo, is a military and commercial center. It is on the east coast rail line and highway. A light rail line provides an alternate connection with Hungnam, 7 miles southeast, and runs north to large hydroelectric developments. A landing ground is west of the city. There are military and commercial warehouses.

(3) Hungnam (Kōnan; 1941 estimated population: 140,000).

Hungnam, 50 miles north of Wonsan, is a port and the site of the Chōsen Nitrogen Fertilizer Company, a large industrial enterprise producing a variety of chemicals and metals. It is on the east coast rail line and has an alternate connection with Hamhung by means of a light rail line. A highway to Hamhung connects with the east coast highway. A landing ground is 5 miles southwest.

The Chōsen Nitrogen Fertilizer Company and its subsidiary, the Chōsen Nitrogen Explosives Company, have several large factories, many workers' dwellings, extensive warehouses, and oil storage facilities.

(4) Songjin (Jōshin; 1937 population: 23,496).

Songjin is a small port and industrial center on the east coast rail line and highway 85 miles south of Ch'ongjin (Seishin). The chief factories are the Japan High Frequency Heavy Industry Company (special steel) and the Nippon Magnesite Chemical Industries Company (magnesium). Facilities include warehouses along the waterfront and small railroad shops.

(5) Nanam (Ranan; 1939 estimated civilian population: 22,500).

Nanam, a few miles south of Ch'ongjin, is a military center and the provincial capital of Hamgyong-pukto (North Kan-

kyō). The east coast railroad and highway pass through the town. Garrison buildings include the 19th Division headquarters, 4 regimental areas, warehouses, and a military hospital. The town has various garrison buildings and small repair shops.

(6) Ch'ongjin (Seishin; 1940 population: 197,918).

Ch'ongjin, the largest city in northeastern Korea, is a port about 50 miles south of the Manchurian border. It has a large transit trade between Japan and central Manchuria, and is the site of an important new iron and steel industry. A branch rail line connects the city with the east coast line, which continues northward to Hoeryong (Kainei) and central Manchurian points; a line to Najin (Rashin) is probably complete. Ch'ongjin is on the coastal highway; another road runs northward to Hoeryong.

The main industrial plants are the Japan Iron Works, the Mitsubishi Iron Company, and the North Korean Oil Refinery. The largest group of warehouses is along the wharves in the eastern section. There are large railroad repair shops.

(7) Najin (Rashin; 1940 population: 38,319).

Najin is a military port northeast of Ch'ongjin. A rail line runs to Unggi (Yūki) and continues northwest to central Manchurian points; the line to Ch'ongjin is probably complete. A loop road through Ch'ongjin, Hoeryong, and Onsong (Onjō) passes through Najin. A large military camp overlooks the harbor, and a cavalry remount depot is 2 miles north; warehouses in the port area have an estimated capacity of 40,000 tons. There are repair facilities for small boats and railroad equipment.

(8) Unggi (Yūki; 1937-1939 population: 22,085).

Unggi is a small deep-water port in a fortified area near the Russian and Manchurian borders. The town is on the rail line from Najin to central Manchuria and on a loop highway to Najin, Ch'ongjin, Hoeryong, Onsong, and Kyonghung. A road from Kyonghung connects with a Russian highway. There are 13,500 square feet of warehouse space, and barracks for one or two regiments. There are large railroad shops and a small shipyard.

(9) Hoeryong (Kainei; 1937-1939 population: 22,821).

Hoeryong, on the Manchurian border 60 miles north of Ch'ongjin, is a military, administrative, and transport center. It is on the railroad from Ch'ongjin to central Manchurian points, and is a highway center with 2 roads to Onsong, and roads to Ch'ongjin, Musan (Mosan), and Yen-chi in Manchuria. An airfield is reported west of the railroad.

(10) Musan (Mosan).

Musan, on the Manchurian border 50 miles northwest of Ch'ongjin, is the chief iron ore mining center in Korea, and probably has a population of about 10,000. A branch line connects with the railroad leading north from Ch'ongjin, and another branch is probably complete to Kilchu (Kisshū) on the east coast line. Highways lead to Ch'ongjin, Hoeryong, Kilchu, and southwest to Hyesanjin (Keizanchin). Musan's mines and concentrating mills are operated jointly by the Mitsubishi Iron Company and the Japan Iron Manufacturing Company.

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9. Resources and Trade

A. Introduction.

(FIGURES I - 26 and I - 27)

Korea is not only a strategic link in the supply route for Japanese military operations on the Asiatic mainland, but it is also an increasingly important source of essential war materials, both raw and manufactured. Japan appears to be attempting to increase Korean self-sufficiency in order to ease the strain on the Empire's production and transport.

Northern Korea is the most important part of the country industrially. The abundance of hydroelectric power has made possible the development of important chemical and nonferrous-metals industries, particularly in the region of Hungnam (Kōnan) on the northeastern coast. Because of the concentration of the iron ore and coal fields in Northern Korea, nearly all of Korea's iron and steel capacity is situated there. Central Korea is significant both industrially and agriculturally. The production of machinery, metals, ordnance, and construction materials centers in the Kyongsong (Keijō, Seoul) - Inch'on (Jinsen) - Pū'yong (Fuhei) district. Southern Korea is essentially agricultural; rice is the principal crop but cotton and other crops are grown in substantial quantities. Pusan (Fusan) is important for the manufacture of railroad equipment and for shipbuilding.

B. Food resources.

(FIGURE I - 27)

Korea is a food-surplus country, although much of its exports of food to Japan are at the expense of the adequate nutrition of its people. The agricultural economy is based on the cultivation of rice, but dry cereals play a much more important role than they do in Japan. Livestock raising is negligible. Fishing supplies an important quantity of protein foods, although far less than do cereals and beans. Production of processed foods is low in comparison with western countries, but ranks as Korea's second industry in value of output.

(1) Present food situation.

Nearly $\frac{1}{3}$ of Korea's output of rice, or 1,800,000,000 pounds, is expected to be taken for Japanese use in 1944-1945. To offset this loss of food the Korean diet has been adapted to the increased consumption of other grains. Perhaps 45% of the rice ration is replaced by other cereals, whereas in Japan rice substitutes furnish only about 6% of the ration. Although the total caloric intake has remained about the same, the quality of the Korean diet is poorer than it was before the war. Grain products contribute 75% of the total food energy, and are the principal source of protein as well as starch.

(2) Characteristics of agriculture.

In 1938 about 20% of Korea was cultivated, and about $\frac{1}{4}$ of this was irrigated. Two crops are produced annually on about $\frac{1}{3}$ of the cultivated area. Farms are small (3.8 acres), although larger than in Japan; only 1.4% of farm households had more than 12 acres in 1938. The proportion of tenant farmers has increased greatly under Japanese control, and reached 52% of the total of farm families in 1938. Two percent of all farm families held about $\frac{2}{3}$ of the total acreage.

Korean farms depend primarily upon the use of family labor; hired workers comprised only 3% of the farm labor before the war. The use of fertilizer, although lower than in Japan, ranks high in comparison with other countries. Farm equipment is simple and manual labor predominates; in 1938 only 9% of farm families had improved plows and 0.025% had gasoline engines.

Food crops predominate. Before the war Northern Korea was the principal source of oats and other dry cereals, Irish potatoes, and beans. Central Korea produced a wide variety of crops, of which rice, vegetables, and soybeans were important. Southern Korea ranked first in yields of rice, sweet potatoes, and barley.

(3) Food production.

Although rice occupies nearly 26% of the total harvested acreage, yields per acre are only about half of those in Japan. About 6,000,000,000 pounds are estimated to have been produced in 1944, about $\frac{1}{3}$ below the record crop of 1937. More than 75% of the prewar output came from 7 provinces in the south and west. Dry cereals accounted for about 45% of the harvested acreage before the war, when nearly 3,000,000,000 pounds were produced. Of these, barley, millet, and wheat are the most important. Less than 3,000,000,000 pounds of vegetables were grown in 1944; fruit raising is negligible. Production of Irish and sweet potatoes in 1944 amounted to about 3,000,000,000 pounds. There is little livestock raising and the prewar production of meat was only 125,000,000 pounds.

(4) Surpluses and deficits.

A large rice surplus has been achieved by increasing production and decreasing per capita consumption in Korea. There is also a surplus of soybeans, and before the war about 18% of the soybeans produced were exported. Imports of millet, wheat, and barley offset part of the loss of rice. Sugar and beans are other important deficit items. Within Korea the outstanding food-surplus areas are along the coastal and river plains of the west coast, particularly in Southern Korea. Only the east-coast provinces of Hamgyong-namdo and Kangwon-do have net food deficits.

(5) Fishing.

The Korean fish catch was one of the largest in the Japanese Empire, and yielded annually an average of 2,800,000,000 pounds in the middle 1930's. The greater part of the deep-sea fishing took place off the east coast, and this was the source of most of the exports of sea foods. Sardine, which represented 60% of the catch in 1939, was an important export. About 400,000 persons were dependent upon fishing for their livelihood.

(6) Food processing.

The food-products industries (excluding rice polishing) were second only to chemicals in the value of factory and household output. Alcoholic beverages, confectionery, and canned fish were the leading products in terms of value. Household industry accounted for about 45% of the gross value of all manufactured food products in 1938. The food industries were located chiefly in the environs of the principal centers of population.

C. Water supply.

(FIGURE I - 28)

Water is abundant wherever storage facilities have been provided. Surface waters form the principal source of drinking water; rivers are most commonly utilized, and springs and dug wells are of minor importance. Most of the cities of the south and west coasts have municipal waterworks, and a few have sewerage systems; few inland cities have such facilities. Irrigation and power dams could be tapped for supplementary supplies. Both raw and treated water throughout Korea should be regarded as contaminated.

Eighty-five municipalities (1939) have waterworks, supplemented by shallow dug wells. The latter are often unreliable and may fail during the driest season. The waterworks are reasonably modern, probably comparable to those of Japan; they employ coagulants, sedimentation basins, and sand filters, but are not known to use chlorination. Treated water is distributed by either pumping or gravity, and several cities have networks of cast-iron distribution mains. Consumers draw water from public or private taps or hydrants; average daily per capita consumption is approximately 35 gallons.

Reservoirs impounded for irrigation and generation of hydroelectric power, and numerous irrigation ponds, canals, and ditches, all help to insure an adequate supply of water.

Other aspects of water supply are described in Topics 2, B, (3), and 11, A.

D. Construction material.

(FIGURE I - 29)

Korea normally had an excess of cement, but had to import lumber and tile. Clay, sand, gravel, and stone are generally abundant.

The lumber industry is typically composed of small units, and large amounts of lumber were imported from Japan before the war. The Japanese have planned to expand greatly the production of lumber in Korea, in the hope of increasing the number of boats built with Korean lumber and reducing the country's import requirements. Korea produced about 1,200,000 board feet of lumber in 1939, all from Northern Korea, or about 8% of the lumber produced in the Japanese Empire.

Korea's 7 major cement plants, all in Northern Korea, are believed to be producing at a rate of 1,500,000 tons per year, as compared with 567,000 tons in 1936. There is an excess of capacity, and some plants may have been converted to the production of alumina and pig iron. In peacetime Korea imported most of her tile from Japan, but was self-sufficient in manufacture of common brick.

E. Industrial raw materials and primary processing.

(FIGURES I - 30 to I - 32)

The value of Korea's minerals lies more in their variety than in the quantity of any given mineral. Korea supplies substantial proportions of Japan's requirements of iron ore, coal, tungsten, molybdenum, graphite, mica, and magnesite ore. Anthracite coal was shipped to Japan before the war, and these shipments may now have been supplemented by exports of bituminous. Petroleum is lacking, but at least two synthetic oil refineries have been built since 1936.

(1) Minerals.

Korea's production of iron ore in 1944 is believed to have been about 5,000,000 metric tons (roughly 1,800,000 tons of iron), most of it from the Musan (Mozan) field in the northeast. About 1,400,000 tons of concentrates (averaging 65% iron) are thought to have been shipped to Japan. Tungsten and molybdenum are the principal ferroalloys produced, but Korea also extracts small quantities of manganese, chromium ore, nickel, cobalt, and vanadium. A number of nonmetallic minerals—fluorspar, mica, graphite, salt—are also available.

There is no bauxite in the country, but alumina plants, using aluminous shales and possibly alunite, have been built and others may have been converted to the use of these materials. Known plant capacity is estimated to be about 1/8 of that of Japan, Korea, Manchuria, and Formosa. Korea's aluminum-reduction capacity of about 37,000 tons in 1944 was approximately 1/6 of the total available in the Inner Zone.* Korea extracts about 150,000 tons of magnesite ore annually, and also obtains some magnesium from salt water, especially near Chinnampo. Magnesium-reduction capacity of known plants is estimated to be 7,000 tons, or about 1/3 of the total available to Japan. The relative importance of Korean copper, lead, and zinc has increased with the loss of other producing areas, but it is doubted that actual tonnages have been increased greatly in recent years. Production of smelted copper may be between 10,000 and 20,000 tons annually. In 1943, 7,000 to 10,000 tons of recoverable lead and about 8,000 tons of recoverable zinc are believed to have been mined in the country.

(2) Fuel.

About 6,500,000 tons of coal are estimated to have been produced in 1944. Most of the anthracite is obtained near P'yongyang (Heijō) in the northwest, although production in the Neietsu field, in the southeast, is believed to have increased substantially since 1936. Most of the bituminous and brown coal is produced in the northeast. Korean coal consumption is estimated to have been about 7,500,000 tons in 1944. Imports consisted of coking coal from North China (and possibly from Karafuto), and bituminous from Manchuria and possibly Kyūshū (for use in Southern Korea). Prewar exports consisted almost entirely of anthracite shipped to Japan; it is probable that bituminous, also, is now shipped to Japan from northeastern Korea. The requirements of furnace-grade coke in 1944 are estimated to have been about 600,000 tons. This exceeds the capacity of known by-product ovens, but additional ovens probably have been built.

Korea has no natural petroleum. In 1936, the last year for which detailed statistics are available, net imports of petroleum and petroleum products were about 2,600,000 barrels; nearly 2/3 of the total was crude and heavy oil. Since 1936 at least 2 synthetic-petroleum plants have been built; these have a combined annual capacity of at least 400,000 barrels of petroleum products. A large refinery at Wonsan (Genzan) has about 3% of the capacity of all refineries in Japan, Korea, and Manchuria.

(3) Agricultural and marine industrial materials.

About 6% of the harvested acreage was planted to industrial crops in 1936; cotton represented 62%, and mulberries

* The Inner Zone comprises Japan, Korea, Manchuria, North China, and Formosa.

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for sericulture 15% of this total. Korea exports both vegetable oils and oilseeds. Numerous small enterprises process vegetable and fish oils by primitive methods. Some modern plants produce hardened oils and chemical products from these oils; substantial quantities are obtained from cottonseed, soybeans, and sesame. The production of oil from fish greatly exceeds that from seeds, and fertilizer is an important by-product. Three east-coast provinces furnished 86% of the total.

F. Manufacturing plants.

(FIGURES I - 32 to I - 35)

(1) Iron and steel.

Korea has at least 7% of Japanese-controlled iron-making capacity, 3% or 4% of the steel-making capacity, and a smaller proportion of the rolling-mill capacity. About half of the 900,000 metric tons of pig iron and sponge iron and one-third of the 500,000 metric tons of steel ingots produced in 1944 probably were exported to Japan, principally from ports in the northeast. The output of intermediate rolled products and iron and steel castings probably did not greatly exceed 300,000 tons. The production of iron and steel is concentrated in 2 industrial districts, that of Ch'ongjin (Seishin) in the northeast, and that of Kyomip'o (Kenjiho) in the northwest. The Nippon Seitetsu plants in these cities together possess about 1/2 of Korea's iron-making capacity. Installations producing various types of sponge iron comprise about 1/3 of this capacity. The 2 largest plants have open-hearth furnaces; most of the other steel furnaces are electric.

(2) Chemicals.

The chemical industry furnished 1/3 of the value of Korean manufactured products in 1939, and is the country's leading industry in value of output. Output has probably been increased substantially in recent years. The Chōsen Chisso Hiryo K. K., the leading producer, has a large development in and around Hungnam (Kōnan)—including its suburb of Honamni (Konan-ri)—in northeastern Korea. The country has at least 1/3 of the nitrogen-fixation capacity available in Japan, Korea, Manchuria, and Formosa, 1/4 of the glycerol-refining capacity, at least 8% of the sulfuric acid, chlorine, and caustic soda capacity, and a smaller proportion of the alcohol capacity.

(3) Machinery.

Despite rapidly increasing domestic production, Korea still depends upon Japan for much of her machinery. In 1940 the value of domestic production of machinery and tools was 77,000,000 yen (compared with about 6,000,000,000 yen in Japan), and imports from Japan amounted to more than 160,000,000 yen. The manufacture of machinery is concentrated in the Central Korean industrial centers of Inch'on (Jinsen), Kyongsong (Keijō, Seoul), and P'up'yong (Fuhei).

(4) Ordnance.

The munitions industry is small. The army arsenal at P'yongyang (Heijō) is probably the most important installation. Many plants which formerly produced fertilizers and industrial explosives are probably now manufacturing military explosives.

(5) Shipbuilding and repair.

The shipbuilding and repair facilities of Korea contribute relatively little to total Japanese capacity; the repair facilities

can handle only medium-sized vessels. Pusan (Fusan) and Inch'on (Jinsen) are the chief centers for these activities.

(6) Railroad equipment.

The manufacture of rolling stock, chiefly in Inch'on (Jinsen) and Kyongsong (Keijō, Seoul), is substantial. Although few locomotives are built, Korea's capacity to produce freight cars is believed to be about 1/3 of Japan's.

(7) Motor vehicles.

The production of motor vehicles is small-scale, and the fabrication of replacement parts may now be its principal activity.

(8) Aircraft.

Little is known about the aircraft industry, but its principal functions are believed to be repair, overhaul, and modification. The Army air arsenal branch depot at P'yongyang (Heijō) is one of the 2 or 3 largest installations doing this type of work on the mainland.

(9) Rubber tires.

There are few rubber-goods plants, and only one, at Pusan, is known to manufacture tires.

(10) Textiles.

In 1939 the manufacture of textiles ranked third among Korea's industries in gross value of output; household production furnished more than 1/3 of the total. Cotton textiles represented over 60% of the goods produced. Although an exportable surplus of cotton yarn and piece goods had been developed before the war, the shortage of cotton and the increase in Japanese requirements have probably forced a reduction in domestic consumption. There was little weaving of silk or rayon fabrics, and large quantities of rayon goods normally were imported from Japan. The current production of synthetic fibers is estimated to be about 20,000 tons, or approximately half the tonnage of raw cotton produced in Korea.

(11) Pulp and paper.

Most of Korea's rayon pulp is produced by a plant at Kilchu (Kishū), in the northeast. Efforts have been made to develop the use of materials other than wood for making rayon pulp. Although pulp was formerly exported to Japan, it is believed that all of it is now consumed domestically. The principal paper mill is at Sinuiji (Shingishū), an industrial city in the northwest; before the war it produced wrapping paper, mostly for export. Japan was the principal source of both foreign and Japanese types of paper.

G. Electric power.

(FIGURE I - 36)

The development of Northern Korea's hydroelectric power resources has been an important factor in the industrialization of the country. Capacity in 1944 is estimated to have been 1,800,000 kilowatts, over 3 times that available in 1936. Twenty-eight plants with capacities of more than 10,000 kilowatts had 95% of the total capacity. Three-fourths of Korea's hydroelectric power capacity and over 60% of all hydroelectric and steam capacity is controlled by the Chōsen Chisso Hiryo K. K. and other subsidiaries of the Nippon Chisso chemical interests. The output of all plants is believed to have been

7,000,000,000 kilowatt-hours in 1943, compared with less than 2,500,000,000 kilowatt-hours in 1936.

High-voltage lines connect the large Sui-hō and Choshin-kō developments with the P'yongyang (Heijō) and Kyongsong (Keijō, Seoul) industrial areas. Other lines connect the Chōsin-kō, Fusen-kō, and Kyosen-kō developments with the cities of the northeast.

H. Commerce.

Korea's economy is closely linked with that of Japan: in 1939, 73% of her exports (by value) went to Japan, and 89% of her imports came from Japan. Shipments of food-stuffs (rice) and war materials (coal and iron ore) form a large part of the outgoing shipments. Consumer goods and raw materials for their manufacture accounted for almost half the total imports, and metal manufactures, machinery, and vehicles represented an additional one-fourth.

As a result of the critical shipping situation, Korea probably is becoming increasingly important as a transit zone for goods being moved between North China and Manchuria, and Japan. The tonnage of military shipments from Japan to the mainland is believed to be smaller than that of the south-bound traffic. The ports of the northeast and Pusan, in the south, handle most if not all of this traffic. Despite the recent development of the ports in northeastern Korea, Pusan is believed to maintain its leadership in tonnage handled, followed by Inch'on (Jinsen). Yosu (Reisui), in the south, is an alternate port for Pusan. The new ice-free port of Dasado (Tashitō) serves the growing industries of northwestern Korea and adjacent Manchuria.

I. Finance.

The monetary unit of Korea, as of Japan, is the *yen*. Most of the currency in circulation is issued by the Bank of Chōsen, although notes of the Bank of Japan and the Bank of Taiwan circulate freely. Exchange controls have prevented the exchange value of the *yen* from falling below the officially pegged rate of 23 $\frac{1}{16}$ cents.

Ownership of banking institutions is chiefly in Japanese hands and the policies of the Japanese Ministry of Finance govern the entire Korean financial system. In 1940 the banking system consisted of special banks (Bank of Chōsen, Industrial Bank, and national policy companies), ordinary banks, savings institutions, credit cooperatives, and other institutions. In addition, 3 of the large Japanese banks have branches in Korea.

10. People and Government

A. People.

(1) Numbers and distribution.

The total population of Korea according to the 1941 official estimate was 24,703,897; it is now probably well over 25 million. In 1941 the number of Japanese in Korea was officially estimated to be 717,011 (2.9 percent) living chiefly in the cities and engaged in business or governmental administration (FIGURE I - 37). There were 73,823 other foreigners listed, mostly Chinese (including natives of Manchuria). Nearly all

the large cities of Korea have grown rapidly in recent years with the most spectacular increase of population in the north-western provinces. The greatest concentrations of population are in the southern and southwestern coastal areas where good rice fields are available. (FIGURE I - 14)

(2) Physical, social, and cultural characteristics.

(a) *Koreans.* The Koreans resemble the Chinese and Japanese in physical type, but are culturally distinct. The family system is the basis for social organization, and a number of related families may constitute a single village.

Old social divisions have been altered somewhat in recent times. The social hierarchy today includes the landed aristocracy (*yangban*), the professional men, small landholders and small merchants, the great mass of tenant farmers and laborers, and at the bottom of the scale the soldiers, butchers, and members of other traditionally disdained occupations. Those who have received a modern education either in Korea, Japan, or America form another group which has become increasingly influential in recent years.

The Korean language is quite distinct from that of any of Korea's neighboring countries, but it is closest in structure and vocabulary to Mongolian. It is most commonly written in a mixture of Chinese characters and a phonetic script called *onmun*. The latter is understood by about half the adult population. The Japanese have made a very determined effort to supplant Korean with Japanese but this has been unsuccessful for the most part, and only approximately 15% of the total population are able to understand Japanese. Through teaching in mission schools and in schools abroad, English has achieved relatively wide currency among Korean intellectuals.

Temperamentally, Koreans are inclined in general to be quick-tempered and emotional, and like their neighbors they place strong emphasis on "face." There is a tendency for those from southern Korea to be more phlegmatic and docile than their northern compatriots. Traditionally northern Korea has often been the source of insurrection and revolt.

The major religions in Korea are Confucianism, Buddhism, and Christianity; in addition shamanism and Chondokyo, a political reformist cult, have many followers. Most uneducated Koreans resort on occasion to the practice of magic and demonology characteristic of shamanism. Christianity, though small in number of adherents, is Korea's most active religion, and the Christian churches have been centers for the promotion of Korean culture. Probably because of their eclecticism, Koreans are tolerant in religion and have few strong *tabus*, demanding only a reasonable respect for their customs and beliefs, particularly those connected with ancestor-worship.

The Japanese have encouraged education as a means of supplanting the indigenous culture with that of Japan. Private schools, of which many are conducted by Christian groups, have, however, helped to maintain Korean cultural and national distinctness.

(b) *Japanese and Chinese.* The Japanese in Korea are chiefly government officials, police officials, businessmen, technicians and skilled workers, and a very few farmers. Like the Chinese they engage in little social intercourse with the Koreans and have retained their cultural identity.

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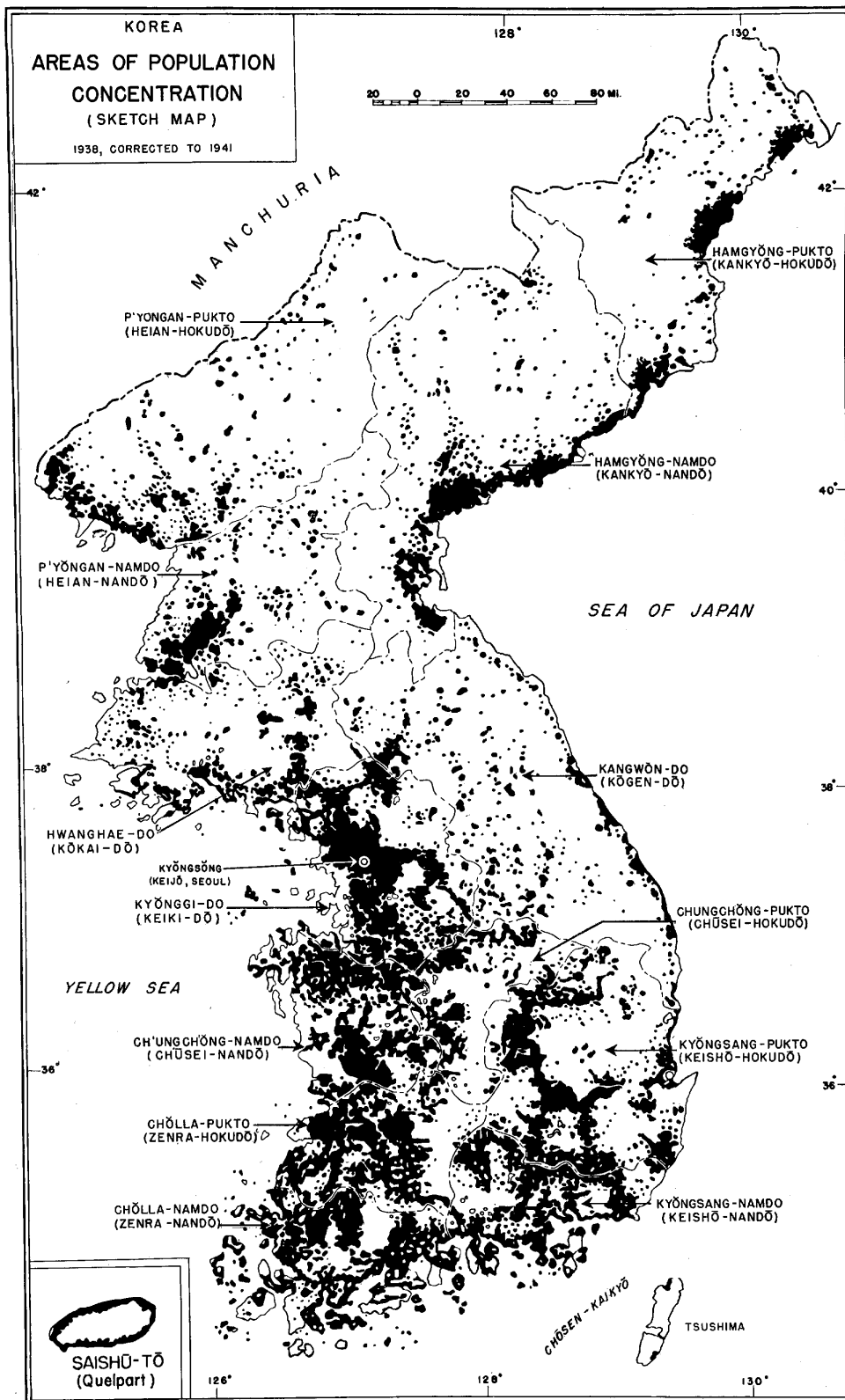


FIGURE I - 14. Population.
Areas of concentration.

B. Labor supply.

The large majority of Koreans, 75% in 1939, are dependent for support on agriculture. Since the recent emphasis on industrialization, the numbers of miners, construction workers, and factory workers has increased. The quantity of skilled labor available in Korea is small, and a very considerable proportion of it is supplied by Japanese. Women play an important role in home industries, farming, and textile industries; in 1938 they supplied 38% of workers in textiles.

Since 1937 all independent labor unions have been rigorously eliminated by the police, but prior to that time labor organizations were active, seeking increased wages, better working conditions, and equal pay with Japanese for the same work.

Traditionally labor has been recruited through labor brokers, but recently these have been supplemented by national labor conscription.

C. Government organization.

The administration of Korea is centralized under a Governor-General appointed by the Emperor of Japan, supervised by the Imperial Home Minister and other Ministers within their administrative spheres. The Governor-General, usually a high Army or Navy officer, directs the 7 bureaus of the central administration, the 13 provinces, and through them the municipalities, counties, towns and townships. Town councils offer the Koreans some participation in government, and Koreans supply over 1/3 of the governmental employees. All higher offices, however, are held by Japanese. FIGURE I - 38 shows the location of administrative subdivisions and their capitals.

D. Political factors.

Only a limited number of Koreans have benefitted to any considerable degree from Japanese rule, and most Koreans resent Japanese discrimination, exclusion from any real share in home government, forced cultural Japanization, and the arbitrary use of police powers. Although the youth have been subjected to intensive Japanese indoctrination, general Japanese reluctance to accept them in positions of trust and other discriminations have militated against genuine sympathy between the two peoples.

Despite Japanese suppression, organized Korean resistance has never wholly ceased. Within Korea there have been sporadic revolts; underground resistance groups exist among students and in urban areas; and guerrilla bands have been recurrently active in the mountains along the Korea-Manchuria border. Exile groups in Chungking-controlled and Communist China, in the United States, and in the Soviet Union have supported independence and, in some cases, are believed to have contact with underground groups in Korea. The Provisional Government in Chungking is supported by most of the exile groups but, while it has some prestige within Korea as a symbol of national resistance, its connections there are necessarily remote.

Liberation of Korea from Japanese rule will bring to the foreground many potential problems now obscured by common hostility to the Japanese, among them latest class conflicts and a strong tendency toward factionalism within the nationalist movement. Despite these factors and the lack of Korean

experience on higher government levels, most Koreans believe in their ability to govern their country adequately and would prefer initial inefficiencies of administrative inexperience to extended control by a foreign power. As an alternative to complete independence, however, an international regime would be preferred by many to control by a single power. Should control by a single power be found necessary, the United States would probably be favored for this role.

E. Security and public order.

Public safety activities in Korea are carried on by two organizations, the civil police and the military police. The civil police are directed by the Governor-General through the Police Bureau and its local offices in the provinces and local subdivisions. The military police are under the commander of the Japanese Army in Korea and have jurisdiction over civilians as well as military personnel. In addition to functions customarily carried on by police forces, the police also control "dangerous thoughts," enforce sanitary regulations, engage in censorship, and enforce restrictions on buying and selling. Arbitrary exercise of extended power has resulted in widespread Korean fear and hatred of the police whose activities they have been forced to accept without question or demur.

Domination of the police force and monopoly of positions of importance by the Japanese will necessitate reorganization of the police personnel. Since Koreans in the police force are either pro-Japanese or in subordinate positions, it will probably be necessary in the early stages of occupation to provide close supervision and supplementation until it is possible to recruit additional Koreans to fill vacant posts.

It is often difficult for a Korean to obtain justice or protection from the courts because he cannot obtain competent counsel, and most cases involving grievances against any aspect of Japanese rule are never brought to court. Where Koreans are concerned, the laws of Japan in force in Korea are apt to be applied even more strictly than in Japan proper, while in cases between Japanese and Koreans the former tend to be favored.

F. Tsushima.

Tsushima, a group of islands between Korea and Japan, is part of Japan proper and is under the jurisdiction of Nagasaki Prefecture. The civil administration of the islands is conducted through the branch office (*shicho*) in Izuhara, on Kamino-shima. Under this office there are 2 districts, governed from Izuhara and from Sasuna on Shimano-shima, in each of which places there is a police station. According to the 1940 census Tsushima had a population of 56,588, occupied in fishing, forestry, metal working, and activities connected with the naval base. Foreigners are probably excluded from the Tsushima group, as a fortified zone of strategic importance, and among the native inhabitants the Japanese language, customs, and social patterns prevail.

11. Health and Sanitation**A. Water.**

The natural water resources of Korea (Topic 2, B, (3)) provide an adequate supply of fresh water, although the annual

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precipitation is not very large, and shortages of water supplies occur from time to time, especially in some of the larger cities and towns. There are approximately 85 waterworks in Korea; all 20 cities and many towns have modern waterworks which supply between 20% and 63% of the population of those communities. More than 80% of the total population of Korea depends on wells, springs, creeks, and similar sources of water; most of such sources are heavily contaminated.

Water supplies in Cheju-do (Saishū-tō, Quelpart Island) are scarce and the settlements are located near the few existing springs. Storage tanks are widely used. The natural water resources of the Tsushima island group provide an adequate water supply.

In Korea proper, Cheju-do (Quelpart Island), and the Tsushima island group, all untreated water, regardless of its source, should be considered unsafe.

B. Waste disposal.

The night soil from most homes in Korea and the Tsushima island group is collected from poorly protected privies and pails and stored in crude, leaky cisterns, from which it is removed from time to time for use as fertilizer.

Waterborne sewerage systems are known to have been established in 18 cities of Korea, but the majority of the population depends on more primitive methods of waste removal. Open gutters are used to carry off liquid wastes in most settlements.

C. Harmful animals.

The chief mosquitoes acting as vectors of disease are *Anopheles byrcanus sinensis* (malaria and filariasis), *A. maculipennis atroparvus* (malaria), *A. lindesayi japonicus* (malaria), *Aedes albopictus*, (dengue, filariasis), and *A. albopictus*, *A. koreicus*, and *A. togoi* (filariasis). The *Aedes* species, notably *A. togoi*, are also considered vectors of Japanese B encephalitis. Unverified statements claim the presence of *Aedes aegypti*, an important vector of dengue and of yellow fever.

Culex tritaeniorhynchus, *C. pipiens pallens*, *C. sinensis*, and *C. quinquefasciatus* (*fatigans*) represent additional suitable vectors for filariasis. *C. pipiens pallens* and *C. tritaeniorhynchus* have been identified as vectors of Japanese B encephalitis.

The common housefly, *Musca domestica*, is very numerous. The presence of sandflies is suspected, but definite reports are not available.

Fleas are numerous and are dangerous as plague carriers and vectors of the murine type of typhus fever. Bedbugs are common. Lice are numerous and may carry the epidemic form of typhus fever and louse-borne relapsing fever. Mites and ticks are present, the small harvest mite *Trombidium* (*Trombicula*) *akamushi* being a potential carrier of tsutsugamushi disease (scrub typhus fever).

Several species of water snails are important as intermediate hosts of parasitic flukes infecting man. Poisonous fishes are found in Korean waters, and most fresh water fish, crayfish, and crabs are infected with flukes or other parasitic worms.

Rats are very numerous and may spread plague, murine typhus, and leptospirosis. The bite of infected rats causes rat-bite fever (*sodoku*).

Among animals dangerous to man are 2 species of pit vipers, *Agkistrodon blomhoffii* and *A. intermedius*. A few tigers are still living in the mountains of Korea. The leopard, lynx, and

wolf are found occasionally. Poisonous scorpions, spiders, and centipedes have been reported.

The most important pests are *Tabanidae* (gad flies) and *Simulium* species (black gnats). Cockroaches also are extremely common.

D. Harmful plants.

Trees, grasses, and weeds that may cause allergic manifestations by means of irritating pollen occur, but hay fever does not seem to be an important affection in Korea. A few poisonous plants and mushrooms are reported.

E. Food.

Cereals are the mainstay of the Korean diet, followed by legumes and vegetables. Fruit is consumed in small quantities. Fish is the principal food of animal origin; meat is occasionally consumed, and dairy products play an insignificant role in the diet of the great majority of the people. In normal times the Korean diet is fairly well balanced but because of the low standard of living malnutrition is prevalent.

F. Public health.

Public health in Korea is administered by the Police Bureau of the Japanese Government General in Kyongsong (Keijō, Seoul). The provincial and local bodies for sanitary administration consist of the provincial police bureaus and the local police authorities. Although the Japanese police authorities in charge of public health have always been able to prevent and check epidemics, the standard of sanitation for the Korean population remains very low, especially in rural areas.

Large quarantine stations have been established at Pusan (Fusan), Inch'on (Jinsen), and Wonsan (Genzan). Smaller quarantine stations are located at Chinnamp'o (Chinnampo), Ch'ongjin (Seishin), Kusan (Gunzan), Mokp'o (Moppo), Najin (Rashin), Sinuiju (Shingishū), Songjin (Jōshin), Unggi (Yūki), and Yongamp'o (Ryūgampo).

Public health in the Tsushima island group is administered by the bureau of sanitation in the department of police of the Nagasaki prefecture of Japan proper and thus comes under the jurisdiction of the Ministry of Public Health and Welfare in Tōkyō.

Well equipped hospitals are found in the larger cities and in some towns, but hospital facilities in Korea are scarce compared with those available in Japan proper. The actual number of hospitals in Korea can be estimated at about 150 to 160. Exclusive of about 6,900 leper colony beds and 400 beds representing the capacity of the known military and naval hospitals, approximately 6,500 beds are believed to be available for general civilian use. Thus, only approximately 2.7 general hospital beds are provided per 10,000 population as compared with 34 beds per 10,000 in Japan proper and 100 beds per 10,000 in the United States.

There are 6 recognized medical schools in Korea, one of which is for women. In addition one dental school and one school of pharmacy are known to exist. A school of veterinary medicine is believed to be connected with a school of agricultural sciences. A central hygienic laboratory has been established in Kyongsong, and additional laboratories are found in the provincial capitals.

G. Medical personnel.

In 1938 there were 2,931 qualified physicians, 879 dentists, 494 pharmacists, 1,843 nurses, and 1,978 midwives in Korea. The number of veterinarians is estimated at approximately 400. In addition there were about 2,000 vaccinators and more than 3,000 native-style healers in the peninsula.

The ratio of qualified physicians to the total population is low in Korea, being approximately 1.3 per 10,000 as compared with 8.75 per 10,000 in Japan proper and 14.2 per 10,000 in the United States (1938).

H. Social service and relief work.

Relief and social service work is carried out by the Japanese Red Cross, the Japanese Imperial Relief Association (Saiseikai), government agencies, and private organizations. Before the war a great deal of social service work and medical relief was carried out by Christian missions, especially American and Canadian.

I. Diseases.

Amoebic and bacillary dysentery, various forms of diarrhea and enteritis, malaria, and venereal diseases are of military importance and very widespread. Other diseases of military importance are typhus fever (mainly louse-borne) and other rickettsial diseases and skin diseases, including various fungus infections. Trench foot and frostbite also are of military importance.

Diseases of potential military importance are cholera, relapsing fever, and filariasis. Diseases of potential military importance which may be introduced are plague, Japanese B encephalitis, dengue, and possibly sandfly fever. Injuries caused by heat will be of potential military importance during the hot season.

Diseases of minor military importance are leptospirosis, rat-bite fever, rabies, cerebrospinal meningitis, and various helminth (worm) infections, including infections with lung, intestinal, liver, and blood flukes.

Diseases common among the civil population are the following acute communicable diseases spread by the respiratory tract: pneumonia, influenza, diphtheria, whooping cough, measles, scarlet fever, cerebrospinal meningitis, anterior poliomyelitis, smallpox, chickenpox, and mumps; enteric diseases, besides those already mentioned as of military importance, including typhoid and paratyphoid fever, which are very prevalent throughout Korea; chronic infections, including tuberculosis and leprosy which are widespread; eye diseases, especially trachoma; and nutritional diseases, including avitaminoses and malnutrition.

Miscellaneous diseases, most of which are of minor importance in Korea, include actinomycosis, anthrax, encephalitis lethargica, kala-azar, tetanus which is fairly frequent, and tularemia.

Diseases of cattle and livestock which may be a potential danger to man are brucellosis, foot and mouth disease, and glanders.

J. Recommendations.

The following precautions are especially important in Korea:

- Proper treatment of water supply, all of which should be considered unsafe.
- Proper disposal of waste.

Mosquito control for the prevention of malaria, dengue, filariasis, and Japanese B encephalitis.

Fly control for the prevention of enteric diseases.

Louse and mite control for the prevention of louse-borne and scrub typhus.

In areas where sandflies occur, sandfly control for the prevention of sandfly fever.

Rodent and flea extermination and rat proofing for prevention of plague, murine typhus, and leptospirosis.

Venereal disease control.

Proper prevention of schistosomiasis and ancylostomiasis.

Proper handling of food supplies and supervision of food handlers.

Prevention of trench foot and frostbite.

Prevention of injuries caused by heat.

12. Defenses

The defenses of Korea, including the islands of Tsushima and Quelpart, are located so as to protect shipping between Japan proper and the Asiatic mainland and to guard the important ports, airfields, and industries of Korea.

A. Organization of army defense forces.

The Japanese army forces in Korea are under the command of the Korean army with headquarters at Kyongsong (Keijō, Seoul). There are three divisional districts in Korea: Keijō, Heijō, and Ranan. Tsushima is a part of the Kurume Divisional District with headquarters at Fukuoka, Japan. Japanese ground strength in Korea is estimated to be 127,000, of which 120,000 is army ground and 7,000 army air ground. Army dispositions are shown in FIGURE I - 39.

B. Supply and maintenance.

(FIGURES I - 40 and I - 41)

The peninsula of Korea serves Japan as a source of raw materials, as a strategic military supply base, and as a convenient bridge for the movement of military supplies between Japan and her Asiatic empire. The islands of Tsushima and Quelpart are relatively unimportant as war supply sources for Japan.

All classes of military supplies are believed to exist in adequate quantities for the maintenance of troops now stationed in Korea. These supplies could be forwarded if necessary to aid in the maintenance of troops in Manchuria and northern China.

Japan has established a strategical disposition of her supply depots in Korea. The northeastern area adjacent to the troops in Manchuria and in close proximity to Southeastern Siberia, contains important remount depots. The arsenals and ammunition reserves are found in the northwestern sector, while imports of military supplies are handled at the warehouse and storage areas in the southern sector.

Administration of supply with respect to production, procurement, storage, distribution, and transportation is controlled by Japanese Army authorities in Korea through "supply depots," branches, and agencies.

The great volume of military supply movement is carried by the railroads; roads on the other hand are utilized to a greater degree for local supply distribution. Rivers play no significant role in the movement of supplies.

The east coast of the peninsula contains the majority of the principal ports. Along the northeastern coast the port of Najin

Confidential

BRIEF

Page I - 45

(Rashin) services imports from the northern part of Japan. Pusan (Fusan), on the southern coast, with an estimated port capacity of 20,000 long tons per 10-hour day, is the largest port on the peninsula. A comparison between the estimated capacities of roads, railroads, and ports indicates no apparent bottlenecks. A normal balance in the flow of supplies therefore can be maintained into and across the peninsula.

C. Fortifications.

(FIGURE I - 42)

The principal fortified areas of Korea, including Tsushima and Quelpart, are centered around Pusan (Fusan), Najin (Rashin), Wonsan (Genzan), and Aso-wan (Tsushima Sound). Coast defenses are also located at Chinnamp'o (Chinnampo), Inch'on (Jinsen), and Yosui (Reisui). Antiaircraft guns defend the principal airfields, ports, and industries of Korea. Mobile artillery units are located in three general areas: Kyongsong (Keijō), P'yongyang (Heijō), and Nanam (Ranan). Six antiaircraft units are located in Korea. It is probable that some of the railway guns owned by Japan are in operation in Korea.

Although details pertaining to the air defense system in Korea, Tsushima, and Quelpart are incomplete and fragmentary, it is known that a system similar to that in Japan proper has been established and is in operation. Timely warnings against air raids can therefore be expected.

Certain additional areas not reported to be fortified are designated as potential defense zones. These include important airfields, ports, industrial areas, and strategically important landing beaches not included among the known defenses.

13. Naval Facilities

A. Organization and administration.

For purposes of naval administration Korea is divided into two guard districts which are minor counterparts of the naval and guard districts into which the main islands of Japan are divided. The Chinkai Guard District, with headquarters at the Chinkai Naval Station, is the most important of these. It includes roughly the southern and western coasts of Korea and the adjacent sea areas. In addition there is the recently established Rashin Guard District, with headquarters at the Rashin Naval Station, which embraces most of the east coast and adjacent sea area.

Like the naval districts of the mainland the Korean guard districts are responsible for 4 primary functions, which are: coordination of all naval activities; maintenance of the fleet; defense of the sea and air frontiers of the Japanese Empire; and naval training. The commander-in-chief of the guard district is a vice-admiral who is also commandant of the main naval base of the district, and of the district headquarters located there.

Sea forces attached to guard districts include guard divisions, defense divisions, patrol divisions, minelayer divisions, and picket-boat divisions.

District land forces man the defense and lookout stations, and guard naval fortresses, fortified zones, and other installations.

Air forces attached to guard districts function as escort and patrol forces.

B. Naval bases and stations.

(FIGURE I - 43)

The Rashin Naval Station includes a small naval base with facilities for submarines and seaplanes. A patrol division, a picket-boat division, and probably a small guard division are permanently attached. It also has one of the principal naval coal and fuel depots in Korea.

Wonsan possesses a fine natural harbor which can provide unlimited anchorages for all types of naval vessels. There is a supply of coal and fuel oil reported to be used by the Navy, a naval air station for land planes, and a probable seaplane anchorage. A submarine base is reported although its location is unknown.

Takeshiki, on the island of Tsushima, once was the location of a minor naval base. Though there is no positive evidence of its having been reestablished, its strategic location and the excellent natural harbor make this seem probable.

The Chinkai Naval Station is the most important naval base in Korea. It has protected anchorages for a fleet of any size and serves as a small destroyer and minelayer base. It is the location of a naval air station and a submarine base is reported to be in the vicinity. Its known facilities include coal and fuel oil depots, and a dockyard equipped for making minor repairs on warships. There is evidence that these facilities have been expanded since the beginning of the war. Chinkai is especially well located to serve as a base for a fleet operating in the Korea Strait.

Inch'on, though it has been reported to be one of the principal naval coal and oil fuel depots in Korea, actually probably has only a small naval coal storage.

Chinnamp'o is the location of the principal naval coal depot on the west coast. The supply of oil there is small, and reports that it is for naval use are not confirmed.

In addition to the areas mentioned various other submarine bases and small naval bases have been reported. These include 3 submarine bases on the east coast; a small combined naval base and submarine base, a minor naval development, and a possible naval anchorage, on the south coast; and 2 submarine bases and 2 small naval bases on the west coast.

C. Supply and maintenance.

Little information is available concerning naval supplies of coal and oil. The principal supplies are probably at the Chinkai and Rashin Naval Stations, at Chinnamp'o, and at Wonsan. At Chinkai there is a known oil storage capacity estimated at 50,000 long tons and an additional supply of unknown quantity. No information is available concerning the amount of coal. Nothing is known concerning the size of either the oil or coal supplies at Najin (Rashin). Chinnamp'o is the principal naval coal depot on the west coast of Korea and has a supply reported to be 103,320 long tons (105,000 metric tons). It appears to have only a small supply of oil. Wonsan has supplies of coal and oil, and there is a small naval coal storage at Inch'on. In addition to these specifically naval supplies, the coal and oil stored at the various commercial ports would be available for naval use.

There is only one known naval dockyard in Korea and this is located at the Chinkai Naval Station. It is reported to be a minor repair base for destroyers and minelayers, and possibly also for larger vessels. Small craft, up to 150 tons, are built there.

14. Air Facilities

A. Character and distribution of fields.

All airfields lying within the limits of this study are operated by the Japanese Army or Navy with the probable exception of one commercial field. The tabular description of all airfields within the area (in Chapter XIV) is prefaced by a short discussion of organization, supply, and maintenance of the Japanese aviation stationed therein. Because of the limited sources of information, it has been useful to include only well-authenticated installations in the main list (TABLE XIV - 2), and to relegate all others to a supplemental list (TABLE XIV - 3) which includes reported potential sites, abandoned landing grounds, old landing grounds not recently verified, and recently reported but unconfirmed new sites under construction. Certain fields, which appeared on early lists as unconfirmed but have never been mentioned since, have been eliminated entirely. Areas possibly suitable for airfield construction are shown on a map (PLAN 2) included in the plans pouch. Until recently Korea has been untouched by photographic reconnaissance; during the recent B-29 activities photographic coverage of some of the important places has been obtained. Of the 31 installations on the main list 15 have been covered by photography. The photography on 11 fields has been received and information based on photography has been received on 4 more. Air facilities are widely scattered throughout Korea, with greatest concentrations in the areas of Keijō (Kyongsong), Heijō (P'yongyang), Fusan (Pusan), and Genzan (Wonsan)—Konan (Hungnam). Approximate locations of the fields are shown on the Air Facilities map, FIGURE I - 44.

The following tables shows the frequency by class and degree of confirmation of all known air facilities within the present study.

TABLE I - 1
NUMBERS, TYPES, AND DISTRIBUTION OF AIR
FACILITIES IN KOREA

CLASS	MAIN LIST (TABLE XIV - 2)	SUPPLEMENT (TABLE XIV - 3)	
Airfields	6	—	
Landing Grounds	10	35	
Emergency Landing Grounds	12	—	
Seaplane Stations or Auxiliary			
Seaplane Stations	3	2	
Total	31	37	
Grand Total			68

The estimates of suggested operational capacities included in the dimensions column of TABLE XIV - 2 are predicated upon the use of the airfields and landing grounds by Allied aircraft. As an approximate guide to the numbers of Japanese aircraft that could be operated the figures stated should be increased by about 30 percent. Where information is held that a particular field is unserviceable, the suggested capacity has been given regardless of this fact but attention is drawn to the status by a suitable note following the capacity figures.

B. Organization.

(1) Administration.

Japan has no independent air force. The Army Air Force is an integral part of the Japanese Army. Under the general direc-

tion of the Imperial Headquarters, it is administered by the Air Headquarters, which is subordinate to the War Ministry. The Japanese Naval Air Force, an integral part of the Imperial Navy, is dependent upon the Naval Air Headquarters of the Navy Ministry for its general administration.

(2) Tactical organization.

(a) *Army.* Operations orders are issued by the Imperial General Headquarters through the Chief of the Army General Staff to the Ground Army Commanders. In Korea and in Manchuria operations orders are issued to the air units by the Commanding General of the Kwantung Army, through the 2nd Air Army whose Headquarters is located at Hsin-pin (Hsin-ching), or directly through ground army channels. An air army is composed, generally, of two or more air divisions. An air division is made up of two or more air brigades. An air brigade is comparable to a United States Air Force wing and is a highly mobile and flexible tactical unit. It is usually composed of 3 air regiments. There are 3 squadrons in a regiment. There are no air divisions under the jurisdiction of the 2nd Air Army and there is only one air brigade, the 15th.

(b) *Navy.* For operational purposes aircraft are assigned to the Combined Fleet or its subordinate fleets. The major naval air command in the field is the Kokukantai (air fleet). At present there are at least 7 such air fleets subordinate to the Combined Fleet. These fleets have both administrative and tactical command of the air units assigned to them. When engaged in operations, the air fleet usually employs a tactical title of Kichi Koku Butai (Base Air Force), which is merely a division of an air fleet's operational functions from those of administration. The Naval Air Force has a subordinate command known as a Kokusentai (Air Flotilla). During the course of the war 10 Kokusentai commanding shore-based aircraft have been identified in operations. Carrier divisions, of which Japan at its peak had 5, are also called Kokusentai. When engaged in operations Kokusentai usually operate under the tactical title of Kushu Butai (Air Attack Force), which is merely a separation of the air flotilla's operational functions from its administrative functions. The basic unit of the Japanese Naval Air Force which combines aircraft and crews and maintenance personnel is the Kokutai (Air Group). In order to achieve greater mobility the planes and crews of a Kokutai are organized into Hikotai (Flying Unit). The functions of the Kokutai are mainly administrative, whereas the Hikotai make up the tactical units.

(3) Tactical strength.

(a) *Army.* There are no army air divisions under the jurisdiction of the 2nd Air Army and there is only one air brigade, the 15th, located in Manchuria. There are no tactical air units permanently stationed in Korea.

(b) *Navy.* To date the air fleets and air flotillas of the Japanese Naval Air Force have been fully engaged in Pacific operations and none has been identified in Korea. Naval air activity in Korea has been confined to anti-submarine patrols flown by small units of float planes and land planes from Chinkai (Chinhae) and Saishū-tō (Cheju-do, Quelpart I.). These planes belong to the Chinkai Air Group of the Chinkai Naval District. Advanced naval fighter training is conducted at Genzan (Wonsan) where there is a detachment of the Omura Air Group. These fighters might be called upon for operational use in an emergency. Intermediate training in biplane trainers is

conducted at Saishū-tō (Cheju-dō, Quelpart I.). About 8 of the 31 fields and stations in this study are operated by the Navy.

C. Supply and maintenance.

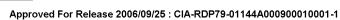
(1) *Army.*

At Heijō (P'yongyang) there is an army air depot that services and supplies two flying training units and two air (ground) training units based in Korea.

(2) *Navy.*

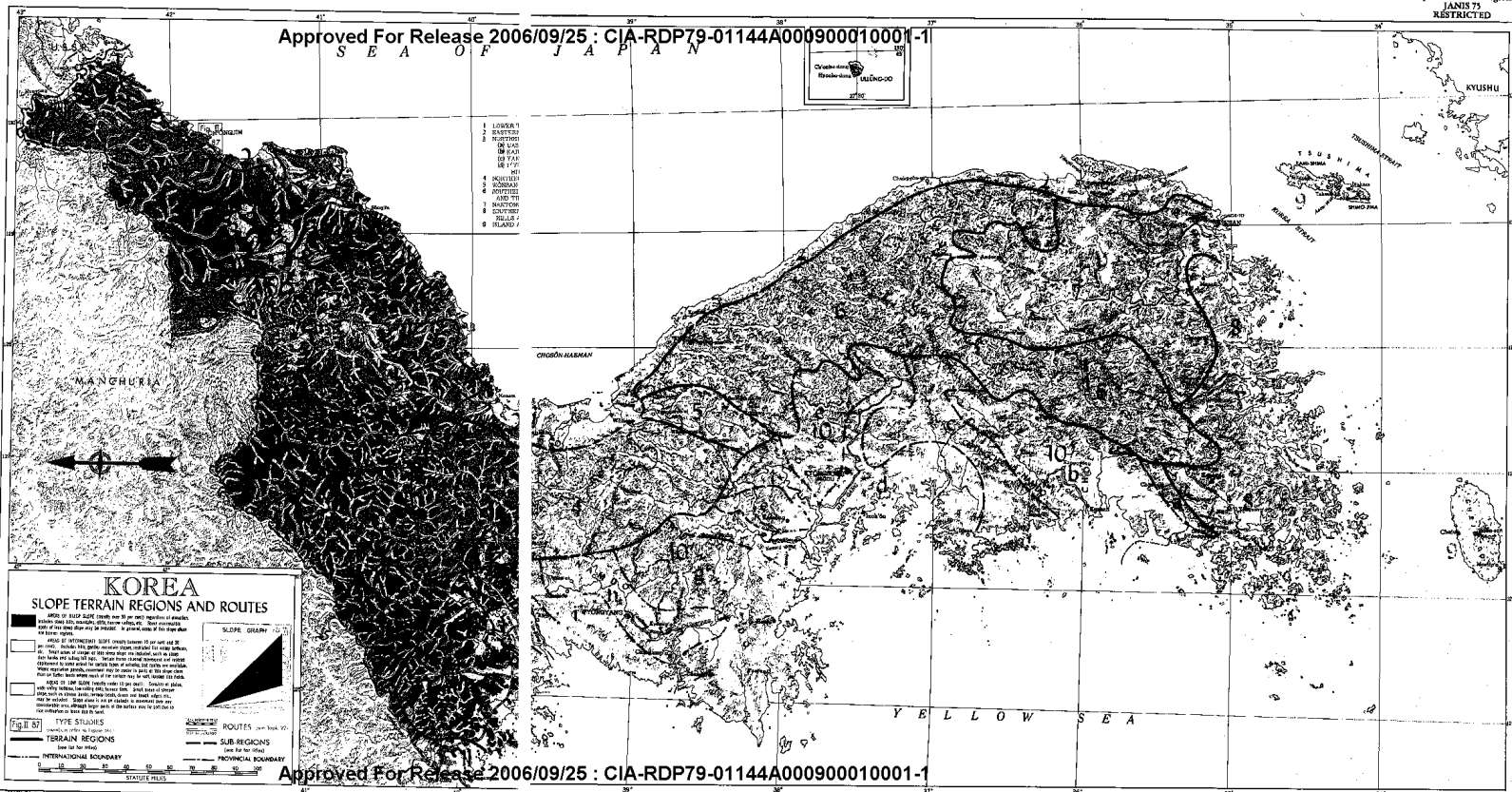
Supply and maintenance are conducted by the naval air depots, which in carrying out their functions operate on directives from Naval Air Headquarters, which is responsible for the planning and equipping of the Naval Air Force.

The 51st Naval Air Depot is located at Chinkai Naval Station. It is responsible for the supply of the air base units that are permanently stationed within the guard sectors of the Chinkai and Ryojun Guard Districts. Subsidiary units are the Chinkai Replacement Shop, the Genzan Branch Workshop, and the Ryojun Special Branch Depot.



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FIGURE I - 16
Slope and Terrain Regions
JANIS 75
RESTRICTED



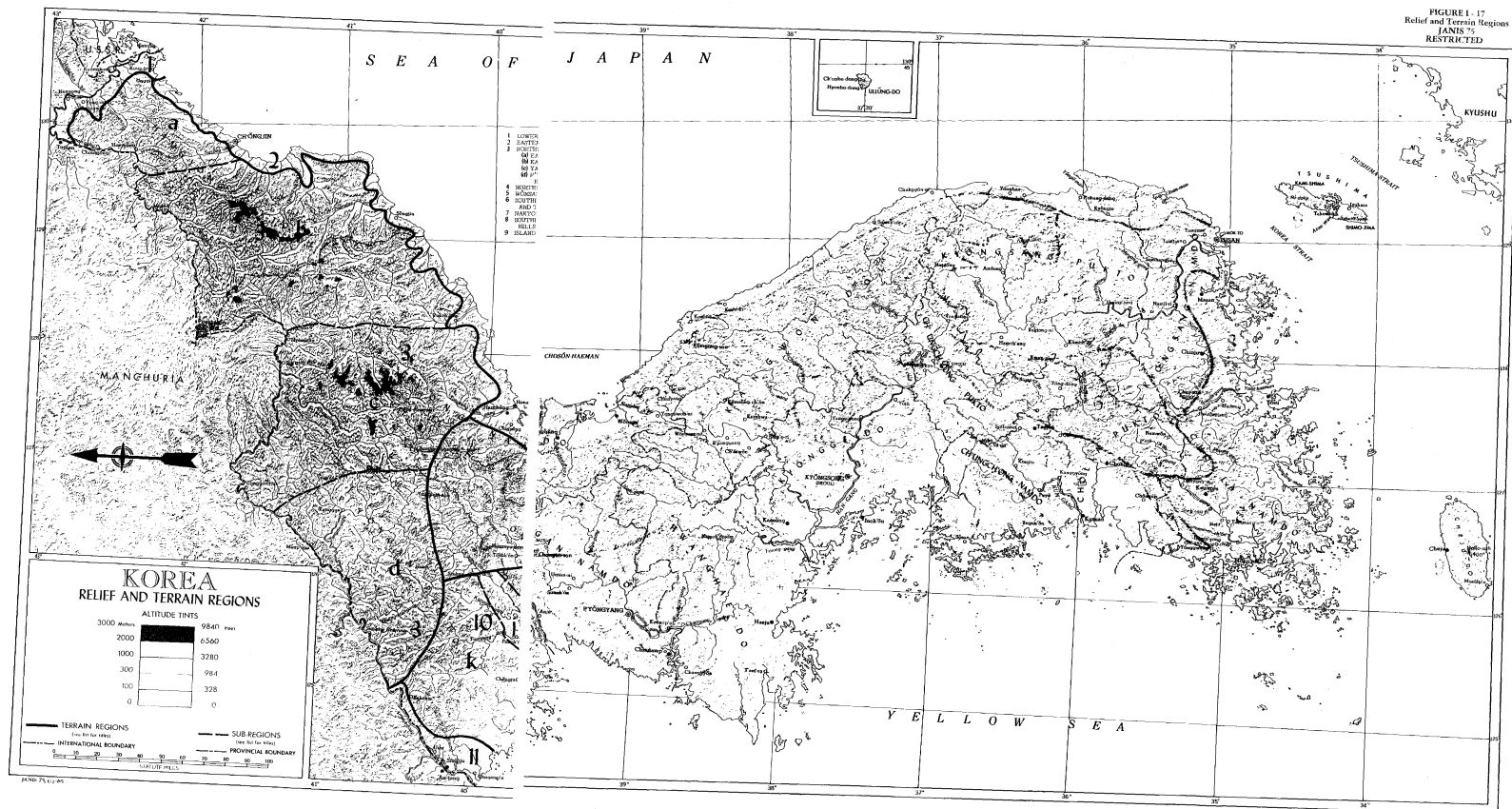
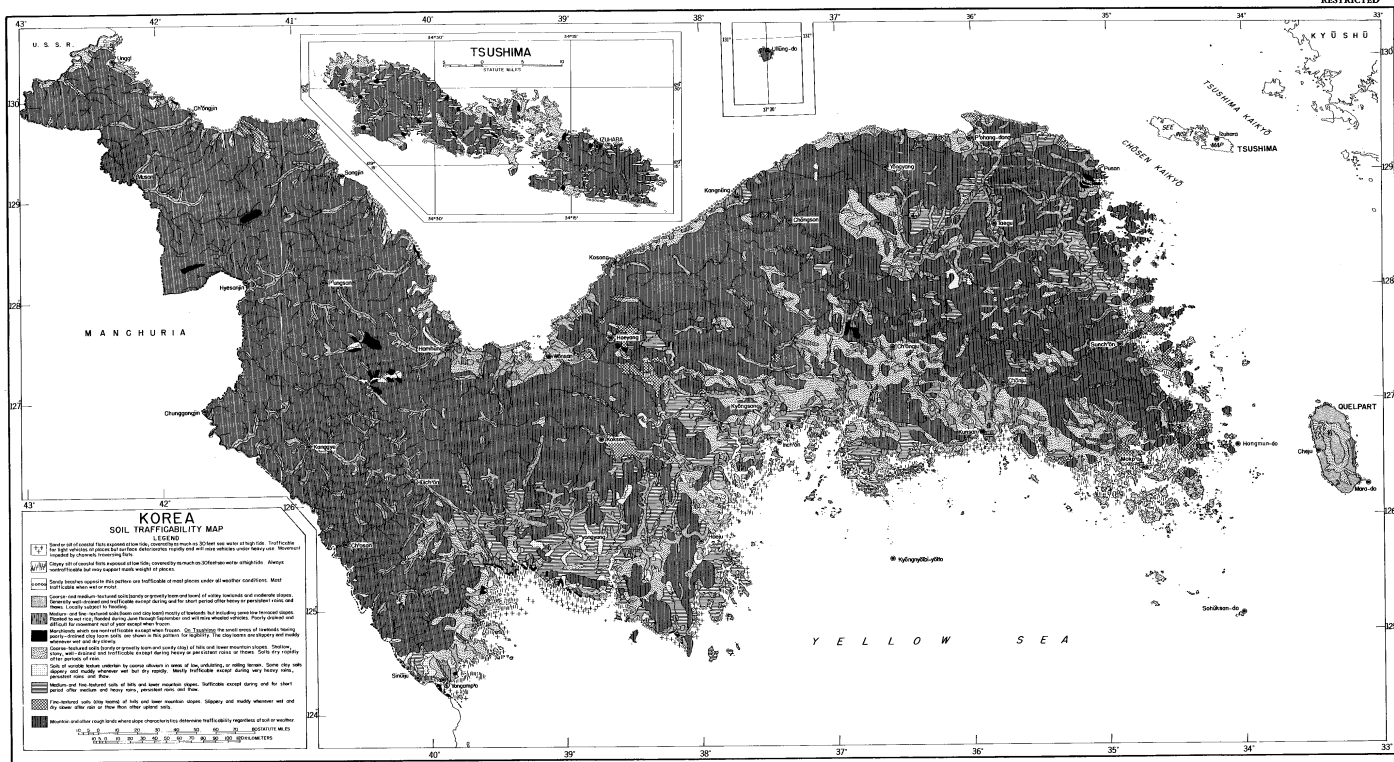


FIGURE I-18
Soil Trafficability
JANIS 75
RESTRICTED



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S E A O F J A P A N

1. LOWLAND
2. MOUNTAIN
3. RIVER
4. RIVER
5. RIVER
6. RIVER
7. RIVER
8. RIVER
9. RIVER

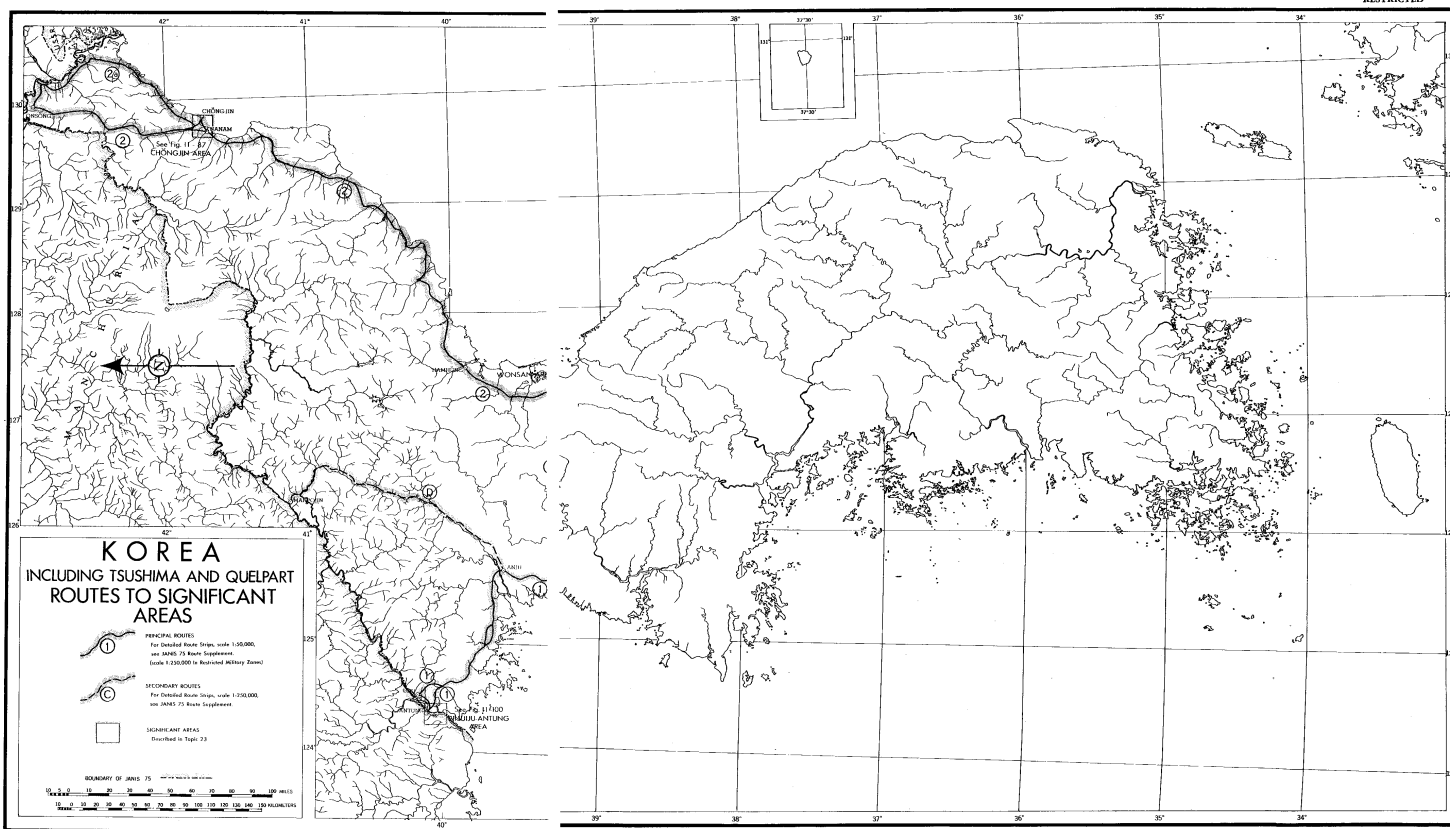
KOREA VEGETATION AND TERRAIN REGIONS

- MIXED FOREST AND GRASSLAND: Pine, Fir, Spruce, Oak, Birch, and Maple (Includes large burned over and cut-over areas)
- BROADLEAF DECIDUOUS FOREST: Oak, Birch, Elm
- CULTIVATED AREAS (Includes wet and dry field crops)
- BARREN AREAS (Practically no vegetation)
- MARSH

TERRAIN REGIONS
SUB-REGIONS
INTERNATIONAL BOUNDARY
PROVINCIAL BOUNDARY
STATUTE MILES

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FIGURE I - 20
Routes to Significant Areas
JANIS 75
RESTRICTED



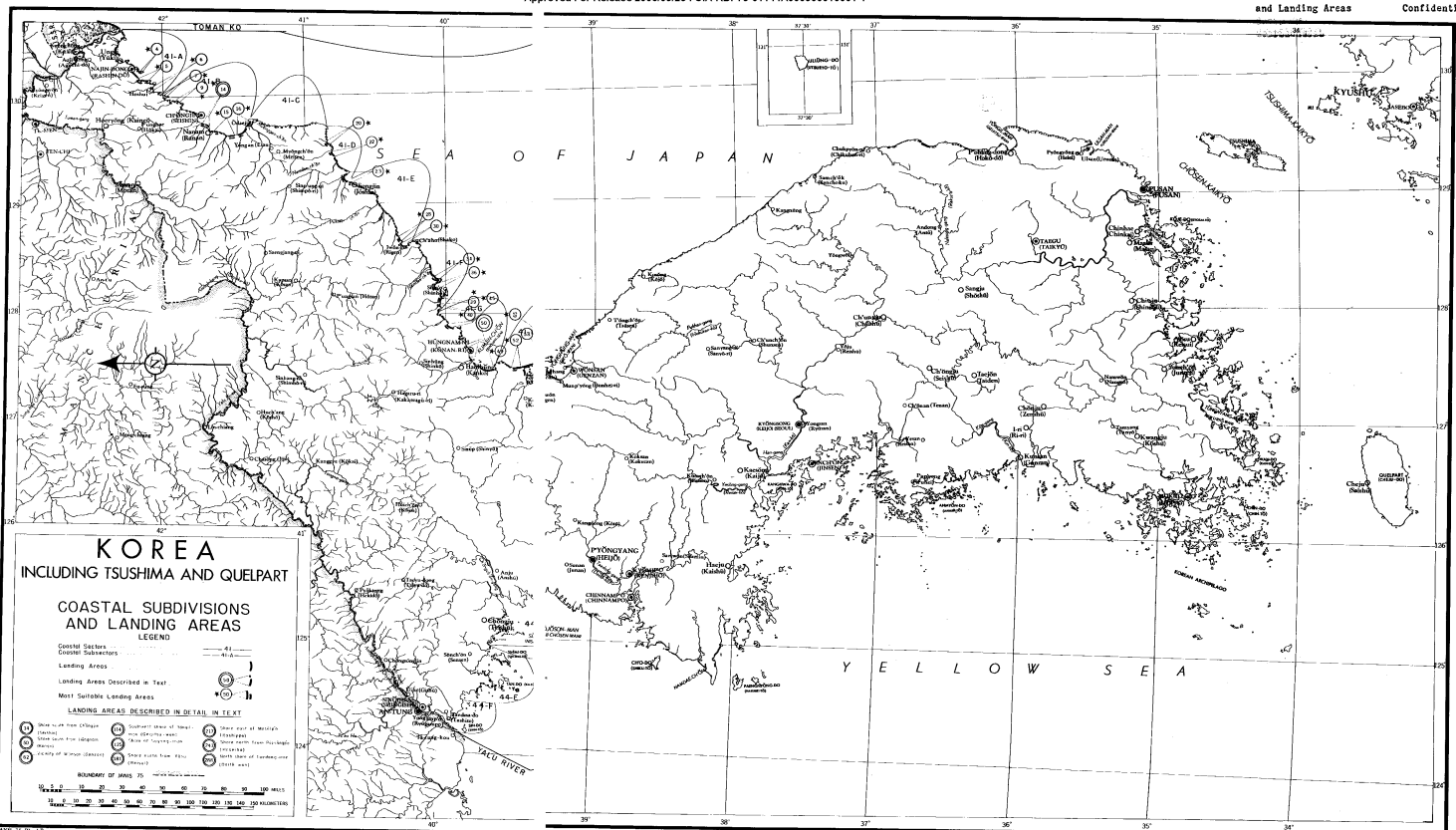
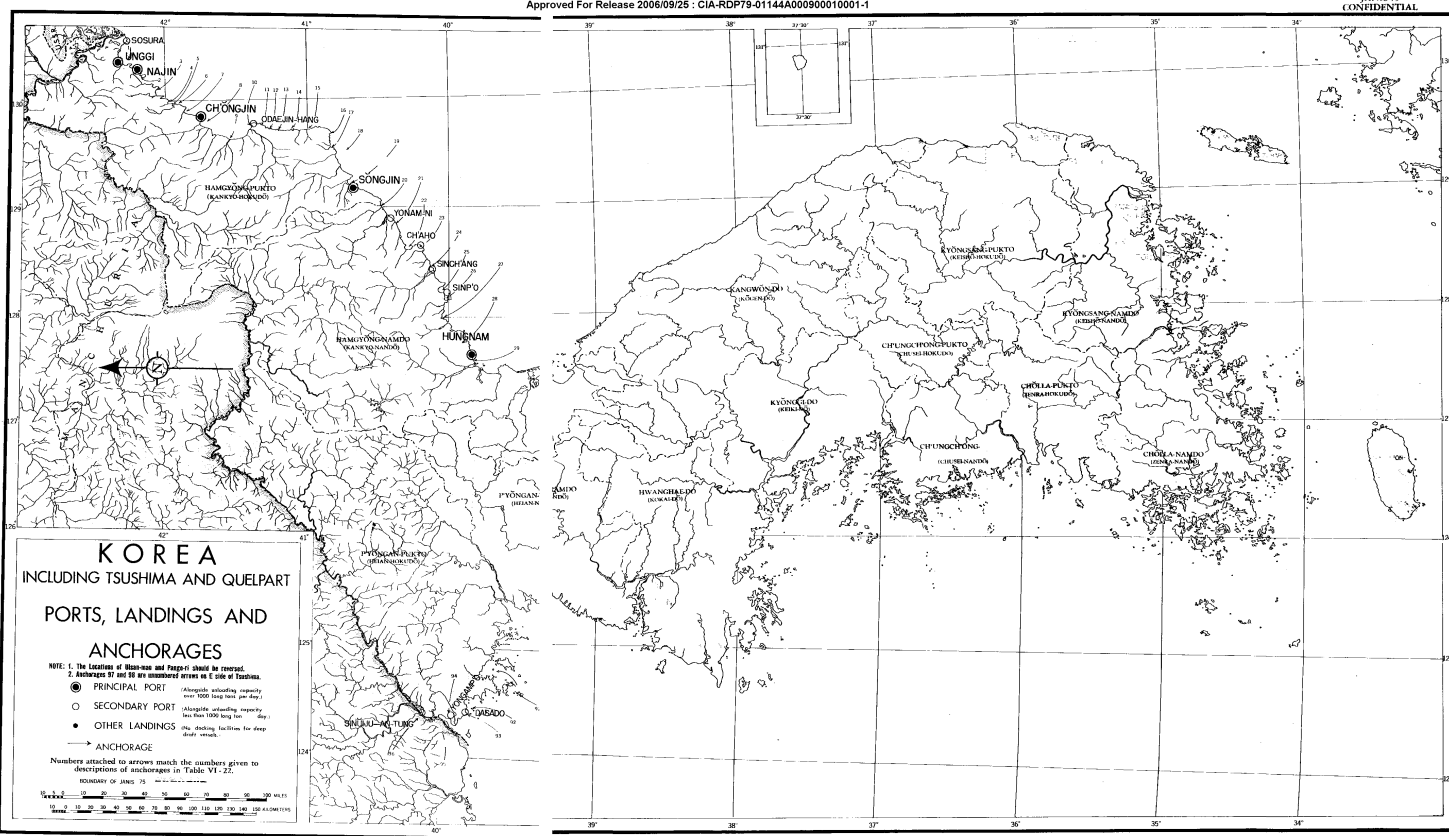


FIGURE I - 22
Ports, Landings and Anchorages
JANIS 75
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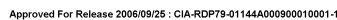
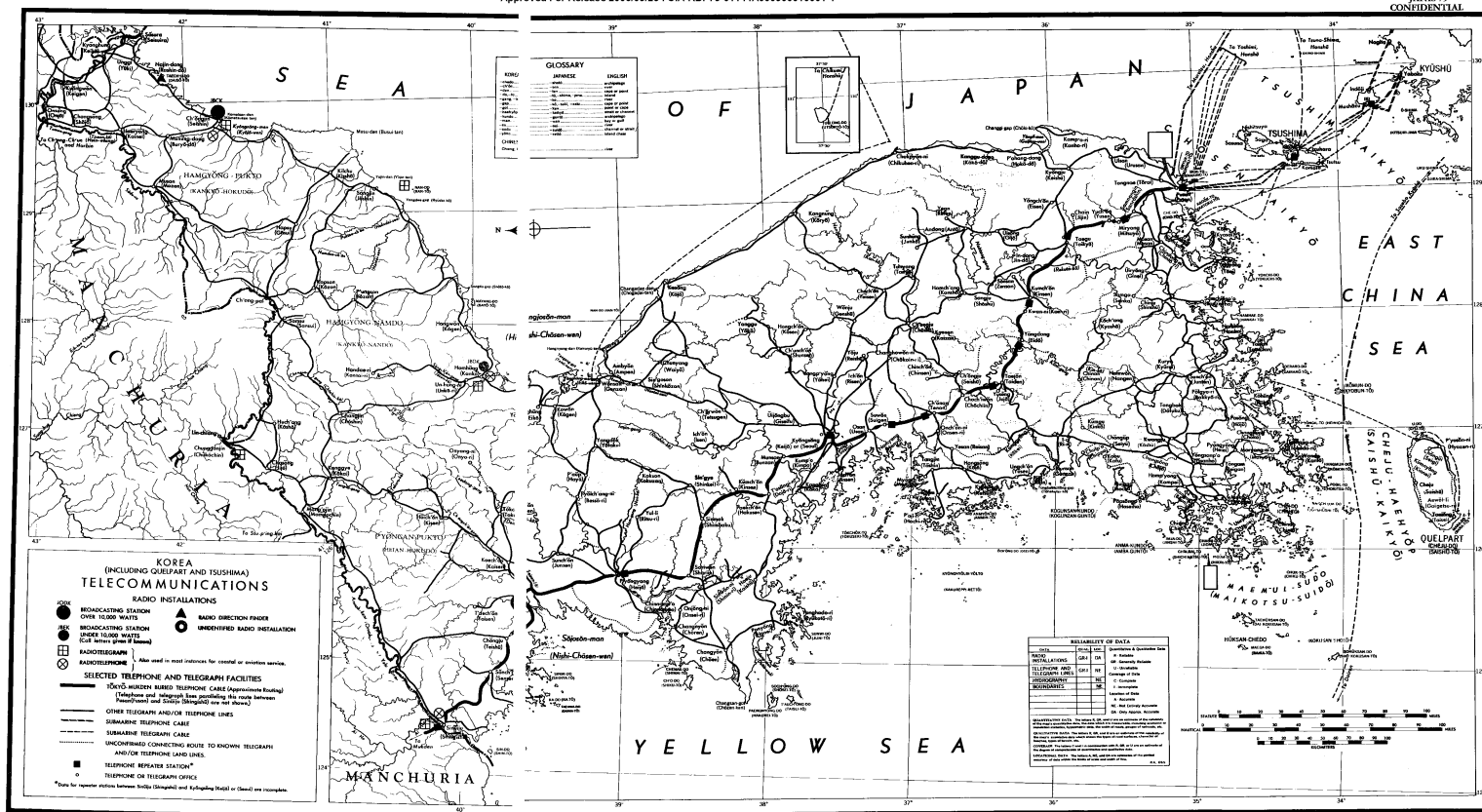
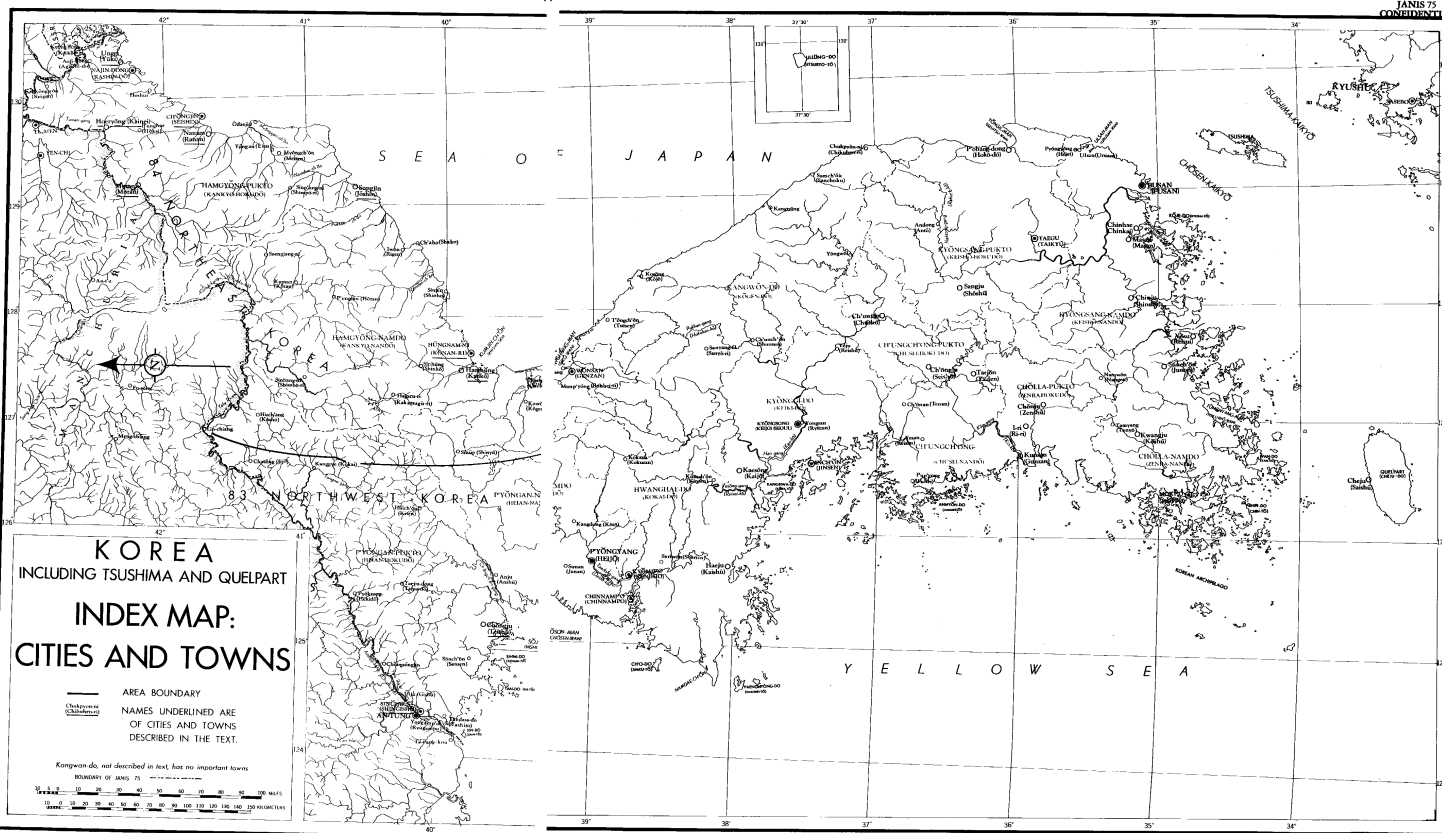
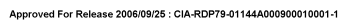


FIGURE I - 24
Telecommunications
JANIS 75
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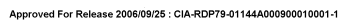




FIGURE 1-29
Construction Materials
JANIS 75
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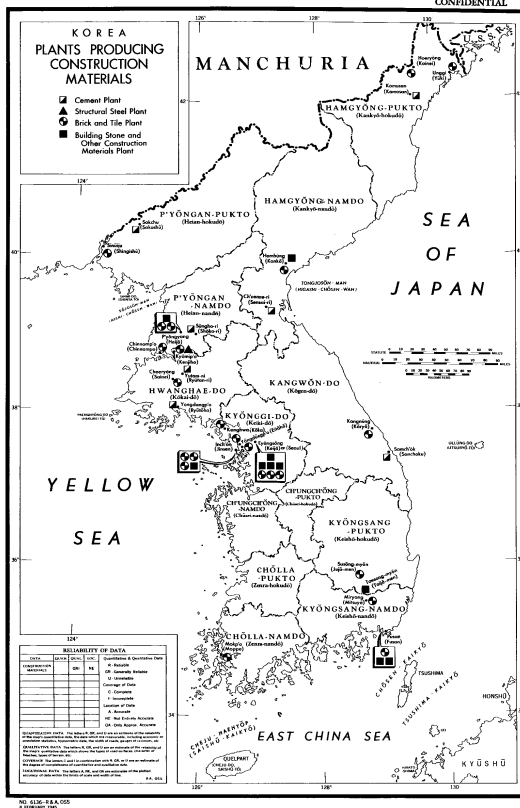




FIGURE 1-31
Korea
JANIS 75
CONFIDENTIAL

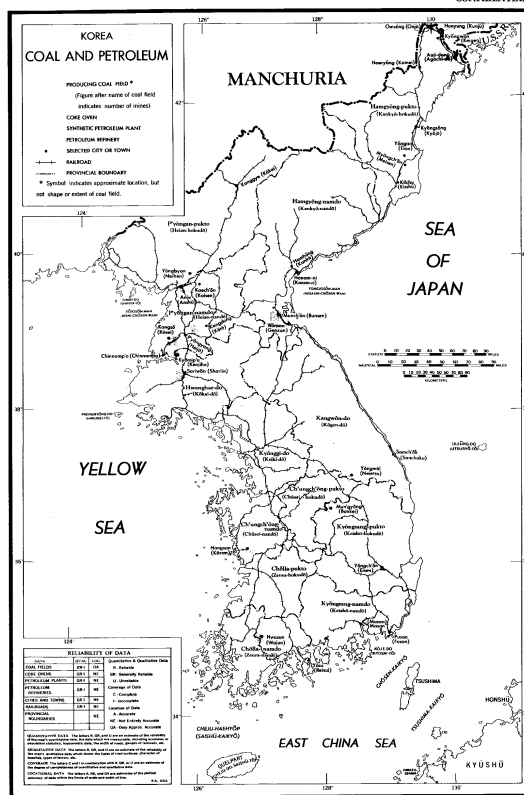
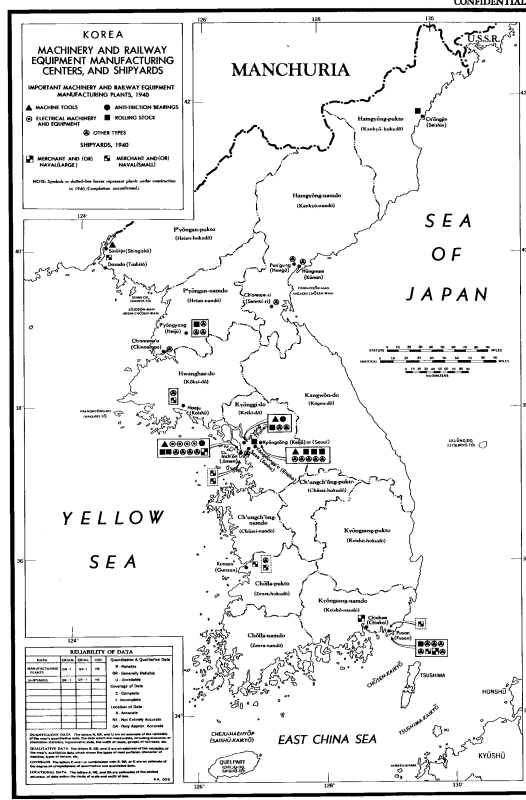
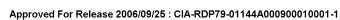






FIGURE 1-34
Heavy Industry
and Shipyards
JANIS 75
CONFIDENTIAL





PLANT NUMBER	PLANT NAME	CAPACITY IN KW.
1	Aguchi Steam Plant	3,000
2	Choshiro No. 1 Hydro Plant	144,000
3	Choshiro No. 2 Hydro Plant	120,000
4	Choshiro No. 3 Hydro Plant	46,500*
5	Ema Steam Plant	6,000
6	Ema Steam Plant	2,000
7	Fune No. 1 Hydro Plant	13,100*
8	Fune No. 2 Hydro Plant	9,400*
9	Fune No. 3 Hydro Plant	5,100
10	Fusan Factory Steam Plant	3,120
11	Fusan Steam Plant	12,800*
12	Fusako No. 1 Hydro Plant	29,800
13	Fusako No. 2 Hydro Plant	41,400
14	Fusako No. 3 Hydro Plant	18,000
15	Fusako No. 4 Hydro Plant	12,273
16	Gensan Steam Plant	1,200*
17	Gensan Steam Plant	3,600*
18	Hagi Steam Plant	18,000
19	Hakko Hydro Plant	3,100
20	Juizen Factory Steam Plant	10,000*
21	Kajiki Steam Plant	1,100*
22	Kakko Steam Plant	3,000*
23	Kakko Kosen Hydro Plant	138,000*
24	Kakko Sachi Hydro Plant	99,400*
25	Kajiki Pyroze Steam Plant	11,000
26	Kajiki Steam Plant	22,500
27	Kajiki Steam Plant	1,000
28	Kajiki No. 1 Hydro Plant	135,000*
29	Kajiki No. 2 Hydro Plant	54,000*
30	Kajiki No. 3 Hydro Plant	32,400*
31	Kajiki No. 4 Hydro Plant	73,000**
32	Kiyosaki No. 1 Hydro Plant	144,000*
33	Kiyosaki No. 2 Hydro Plant	72,000*
34	Kiyosaki No. 3 Hydro Plant	66,000*
35	Kiyosaki No. 4 Hydro Plant	72,000*
36	Murajo Steam Plant	2,250
37	Nakatsu Steam Plant	100,000
38	Rosen Steam Plant	2,000
39	Saiki Steam Plant	2,800
40	Saichiku Steam Plant	30,000
41	Saiki Steam Plant	7,000
42	Saichiku Factory Steam Plant	16,000
43	Saichiku Steam Plant	3,600
44	Shingaki Steam Plant	1,400
45	Shikoku Factory Steam Plant	10,200
46	Sulha Hydro Plant	600,000***
47	Takken Steam Plant	4,200
48	Ungun Hydro Plant	5,120

*Estimated Capacity
 **Estimated Capacity. It is not known whether this plant has been completed.
 ***270,000 kw used for Korea.

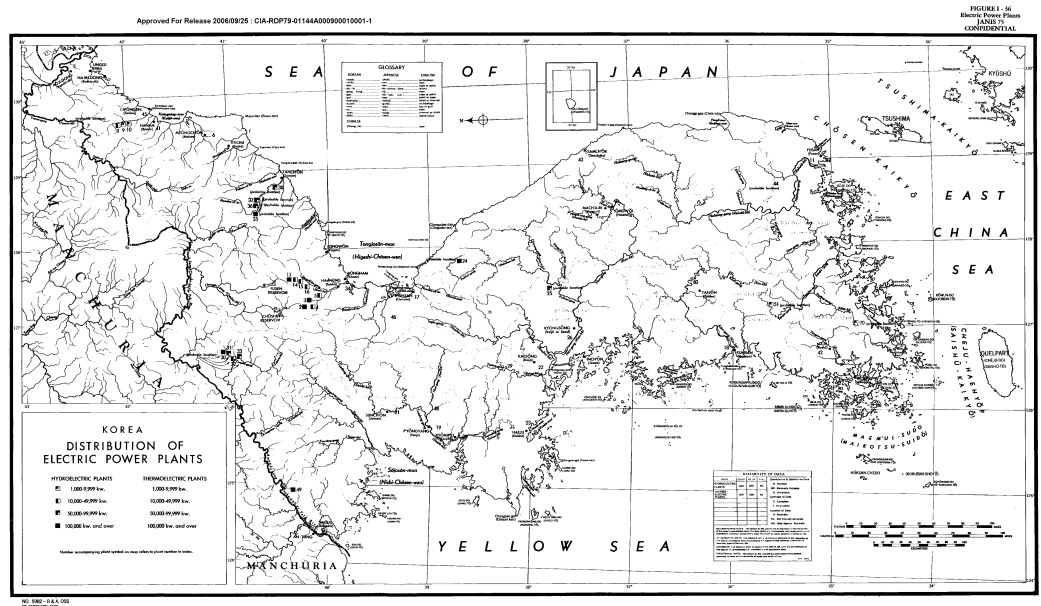






FIGURE I-39
Japanese Army Dispositions
JANIS 75
CONFIDENTIAL

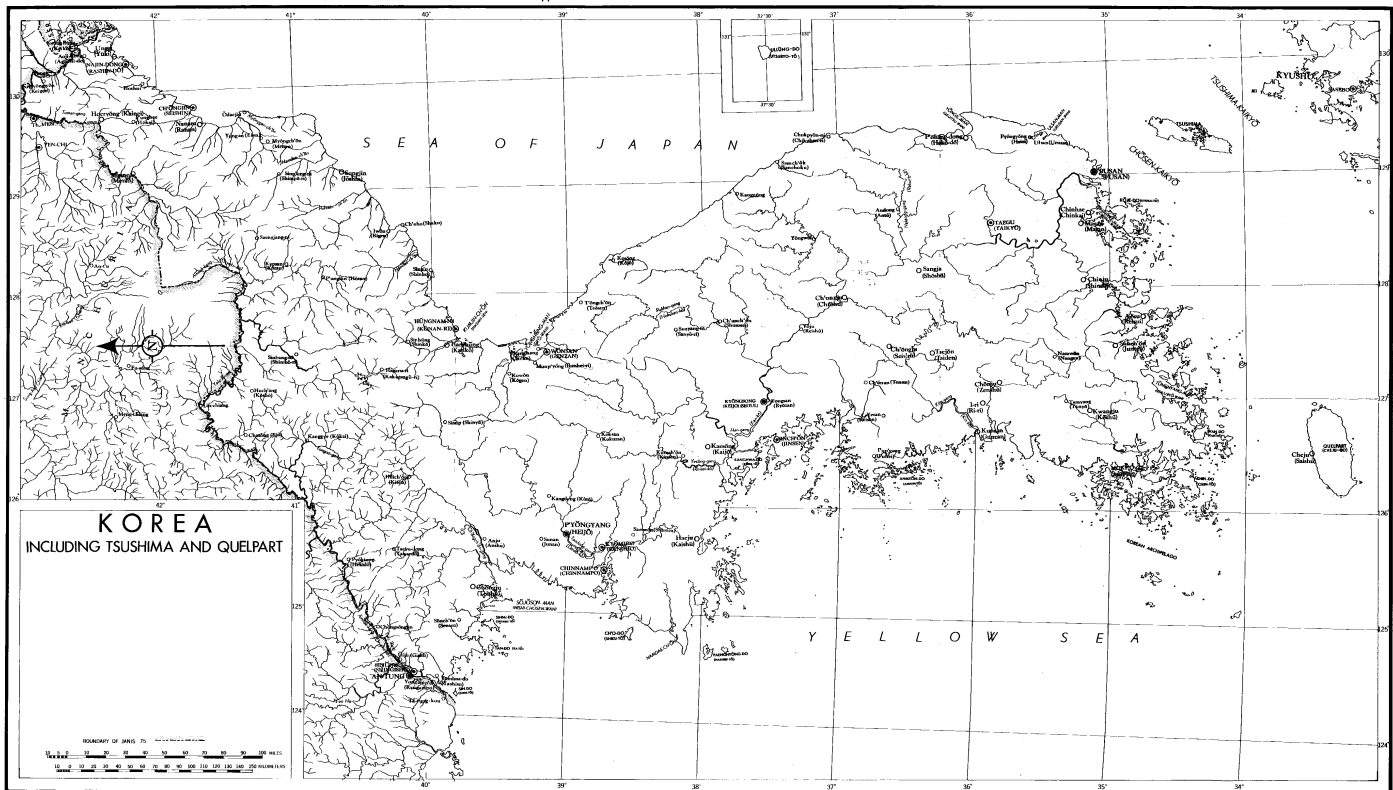
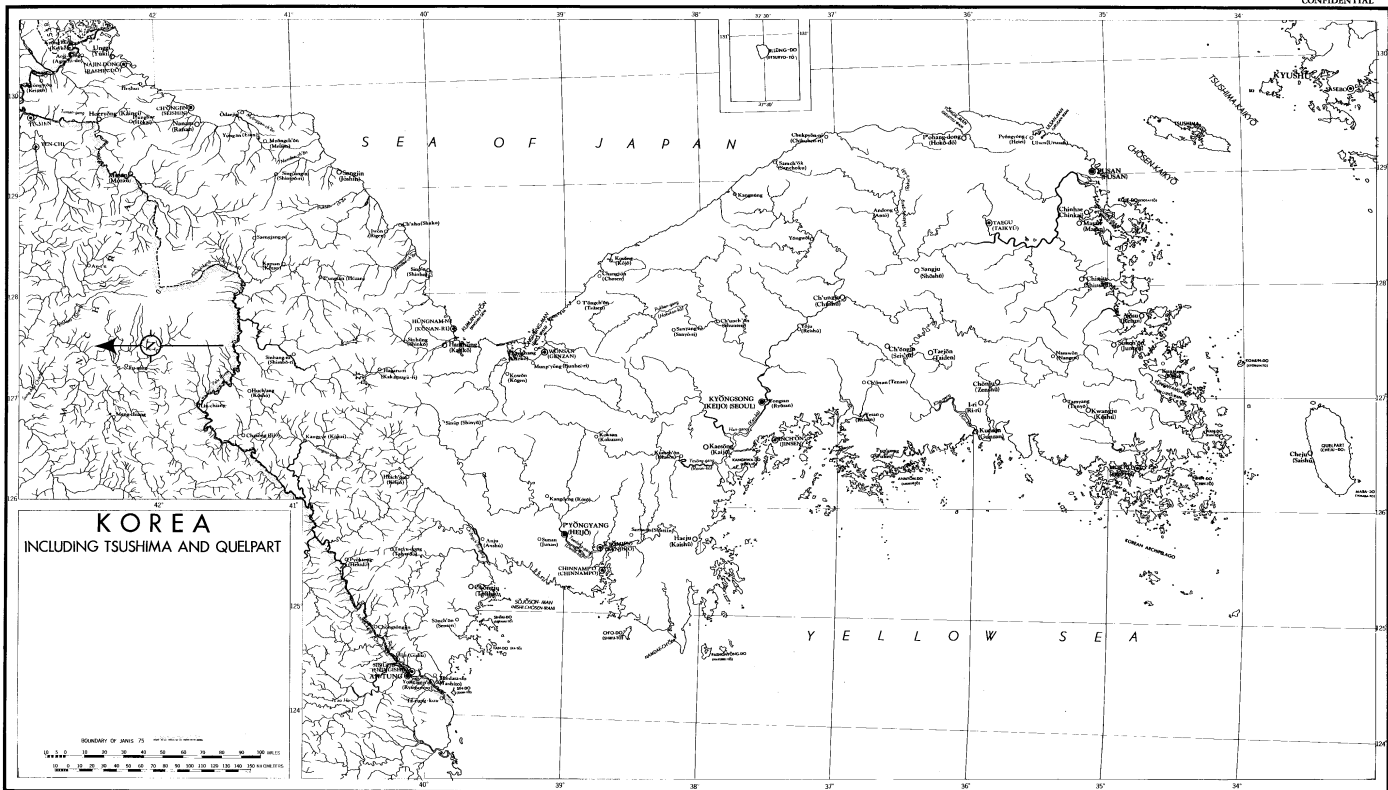
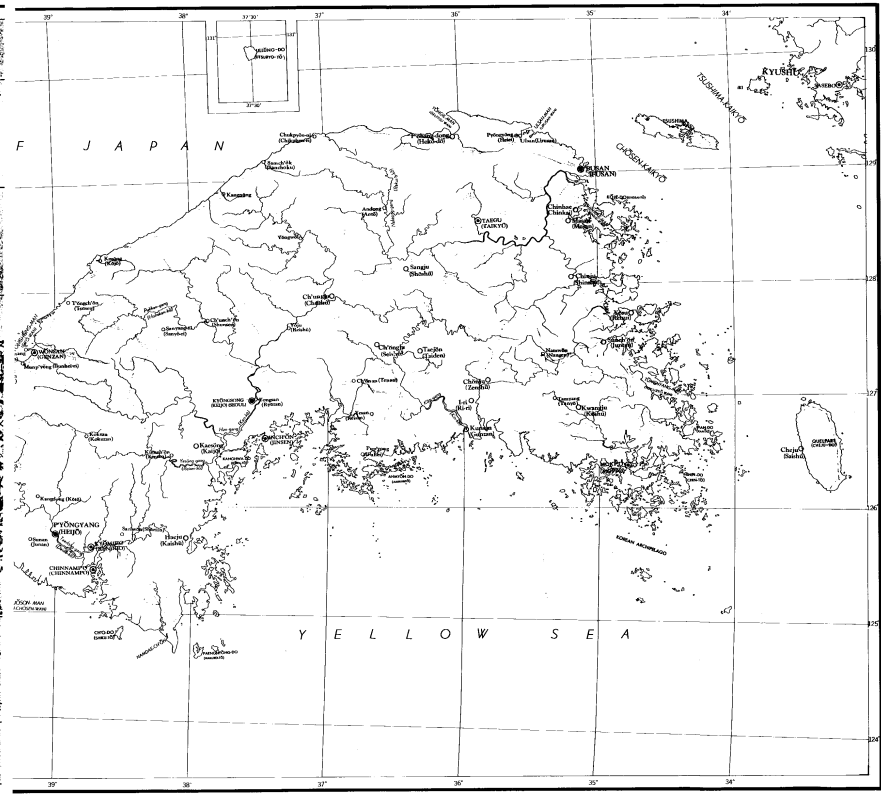
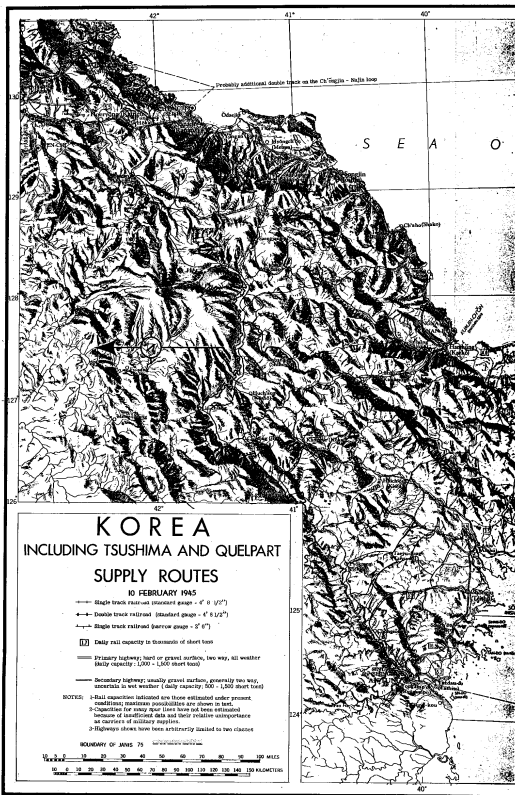
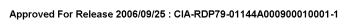


FIGURE 1-40
Supply Installations
and Ports
JANIS 75
CONFIDENTIAL







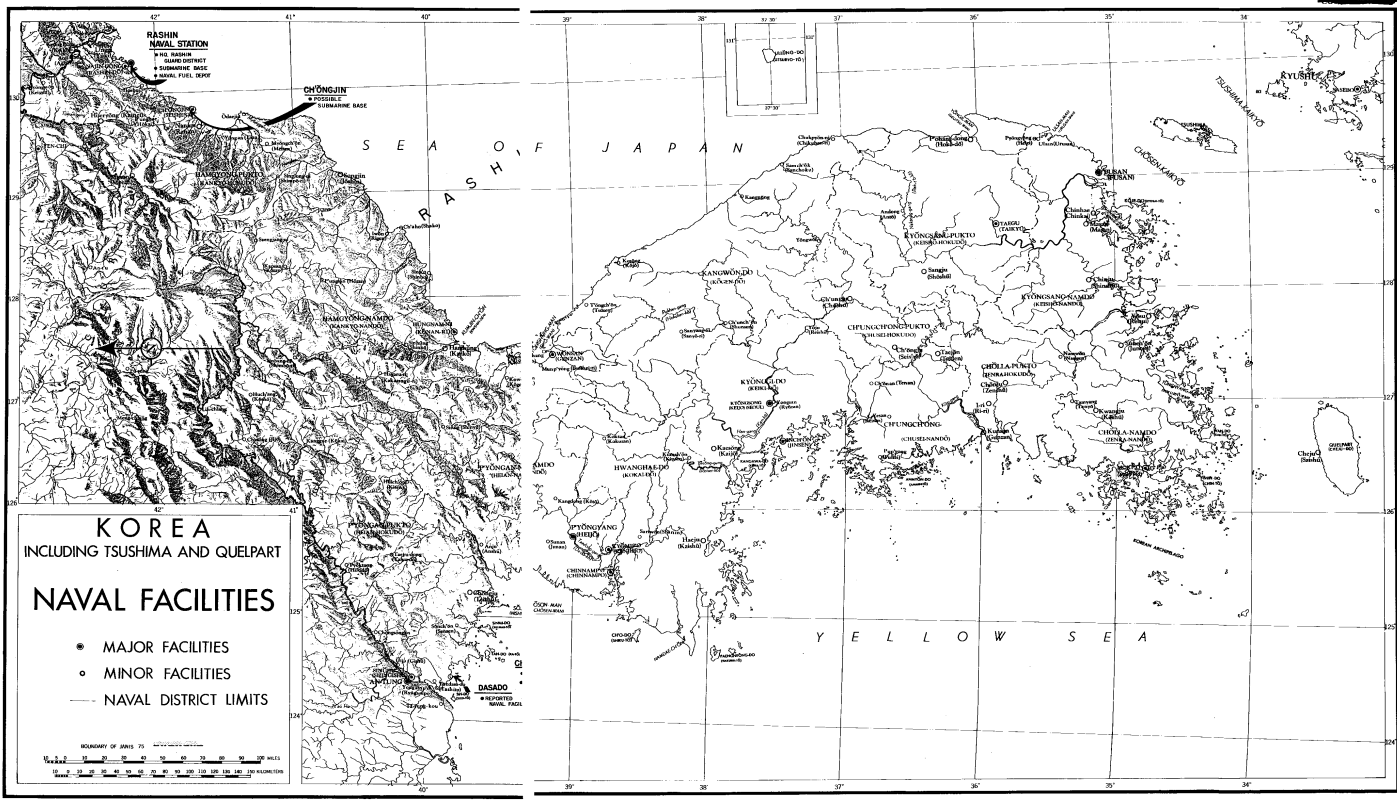
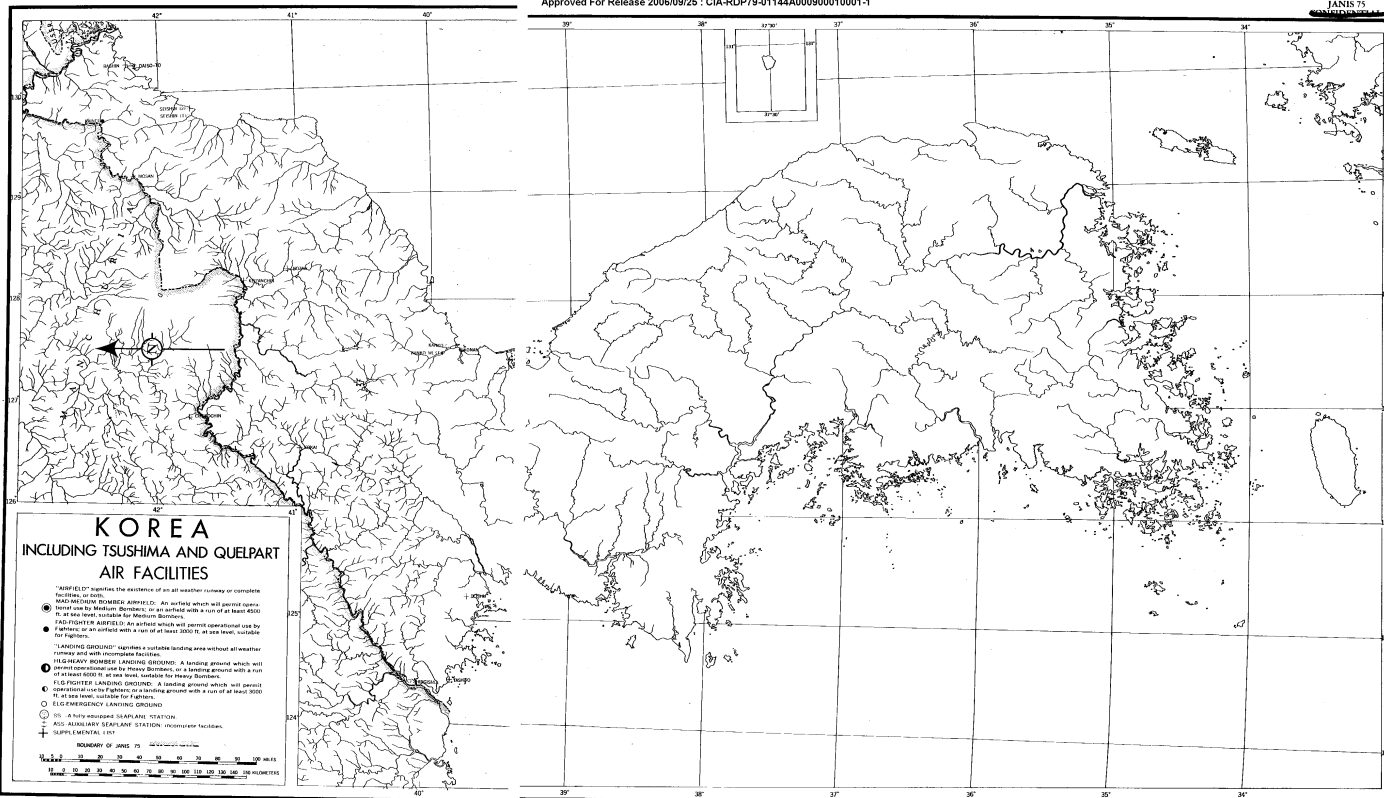


FIGURE 1-44
Air Facilities
JANIS 75



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